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VOL. VII FEBRUARY, 1914 No. 2

The Philippine Agricultural Review

SPECIAL ARTICLES

NOTES ON SIAMESE POMELOS

By H. H. Boyle

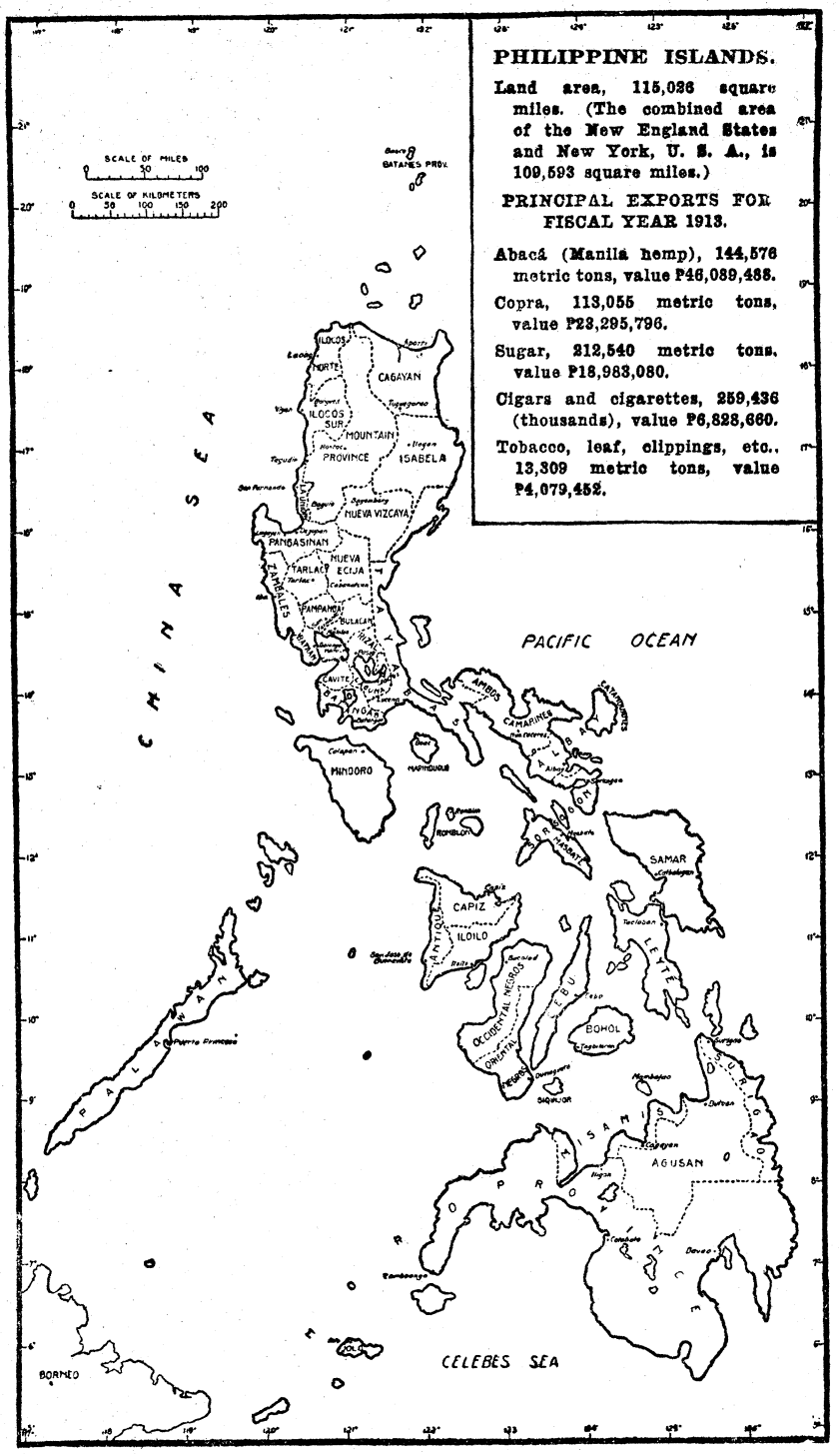
SUGAR MANUFACTURE,
THE MODERN METHOD VS. THE OLD

By C. W. Hines

A MONTHLY PUBLICATION
ISSUED IN ENGLISH AND SPANISH
by THE BUREAU OF AGRICULTURE
The Government of the Philippine Islands
Department of Public Instruction

MANILA
BUREAU OF PRINTING
1914

(Entered at the post office at Manila as second-class matter.)


PHILIPPINE ISLANDS.
Land area, 115,026 square miles. (The combined area of the New England States and New York, U. S. A., is 109,593 square miles.)
PRINCIPAL EXPORTS FOR FISCAL YEAR 1913.
Abacá (Manila hemp), 144,576 metric tons, value P46,089,488.
Copra, 113,055 metric tons, value P23,295,796.
Sugar, 212,540 metric tons, value P18,983,080.
Cigars and cigarettes, 259,436 (thousands), value P6,828,660.
Tobacco, leaf, clippings, etc., 13,309 metric tons, value P4,079,452.
SCALE OF MILES
SCALE OF KILOMETERS
BATANES PROV.
ILOCOS NORTE
CAGAYAN
ILOCOS SUR
MOUNTAIN PROVINCE
ISABELA
NUEVA VIZCAYA
PANGASINAN
NUEVA ECIJA
TARLAC
ZAMBALES
PAMPANGA
BULACAN
RIZAL
CAVITE
BATAAN
MANILA BAY
LAGUNA
TAYABAS
AMBOS CAMARINES
CATANDUANES
MINDORO
MARINDUQUE
ROMBLON
SORSOGON
ALBAY
MASBATE
SAMAR
LEYTE
CAPIZ
ANTIQUE
ILOILO
OCCIDENTAL NEGROS
ORIENTAL NEGROS
CEBU
BOHOL
SIQUIJOR
ZAMBOANGA
AGUSAN
DAVAO
PALAWAN
CHINA SEA
PACIFIC OCEAN
CELEBES SEA
BORNEO

MISSING

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Seedless Siamese Pomelo.

THE PHILIPPINE

Agricultural Review

VOL. VII FEBRUARY, 1914 No. 2

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EDITORIAL.

THE BANANA INDUSTRY.

That period in the progress of an industry wherein radical changes are necessarily made in the methods of handling either its raw or finished products is of great interest not only to the by-standers but to the directly concerned participants. There is a typical case of this kind on the tapis here now: bananas have been grown in a haphazard way in very limited quantities in all sections of the Archipelago; in other countries modern methods of handling this very important crop on a wholesale plan have demonstrated the profitableness of these over those of the old system.

It now behooves the Philippine planters to change their cultural methods of the banana and plantain industry so that it can be put upon a paying basis and enter into the commercial economy of the country. There is no question but that it can be done. There is also no question as to the growing needs of a constant supply of at least a dozen varieties of "fresh fruit" bananas and a still greater oversea demand exists for the various manufactured byproducts of several other types of these fruits.

A brief and practical circular on the subject is, it is hoped, opportune. A more or less scientific bulletin covering the more difficult phases of the matter is urgently demanded as soon as the results of the present experiments along this line, now being conducted at the Singalong experiment station and the Alabang stock farm, shall have been completed; our neighboring countries who have contributed in a very generous and whole-hearted manner toward making this work a splendid success have a right to expect a standard up-to-date work of this kind from the Bureau of Agriculture.

BUREAU OF AGRICULTURE CIRCULAR No. 27—BANANA CULTURE.

[CIRCULAR No. 27. Manila, January 6, 1914.]

BANANA CULTURE.

By O. W. BARRETT, *Chief, Division of Horticulture.*

The banana is the most widely known fruit. Considering the space occupied, this plant probably produces as much, if not more, wholesome human food than any other. It is also one of the easiest to manage of all the food crops. On the other hand it is one of the most abused of the tropical crops, probably the least understood from a horticultural standpoint, and yet one of the most promising considered from the point of intensive agriculture.

In the Philippines there are a large number of wild and semi-cultivated bananas, but among these there are very few, if any, strictly endemic varieties which are of high value as food plants. The exact number of cultivated forms now in evidence in the Philippine Islands is unknown but we believe there are between 100 and 150 horticulturally distinct varieties; on account of the duplication of names in the numerous dialects, however, it would appear to the traveler in the Philippines that fully twice this number of "plátanos" are cultivated. There are cases of the same variety passing under no less than four names in as many provinces, while, on the other hand, there are instances in which it is clearly evident that two or three distinct sorts (for instance, the "Lacatans") are known under one name.

A very interesting feature in working out the synonymy of the Philippine bananas is the comparative absence thus far of inter-provincial exchanges; it would appear very natural that all the provinces in Southern Luzon, for instance, should cultivate the same varieties of bananas through the simple exchange of roots or suckers, especially when we consider that for at least *200 years* there have been excellent opportunities for such exchange.

Most of the cultivated varieties here have been introduced from the East Indies and Malay States, only a very few having come from South China and probably none from any part of the Japanese Empire nor from any of the Polynesian groups.

Site.—The banana leaf, being very easily damaged by strong winds, must be sheltered as much as possible, and therefore either hills or belts of trees should be in evidence to protect banana plantations from prevailing winds. In large plantations cross-belts of leguminous trees should be planted at least every 100 meters. Alluvial areas along streams are to be preferred although narrow valleys and bases of hill slopes may be used providing the soil is not too rocky nor clayey and the exposure to winds not too great.

Soil.—While there are some individual variety preferences among the bananas and plantains, practically all kinds will grow in ordinary soil, even nearly pure clay or sand (if not too coarse) sometimes giving fairly good results. Sedimentary soils and flooded plains usually give the best results, however, providing there is sufficient drainage to prevent stagnation of water for more than two or three days at a time during the rainy season.

The banana root being rather tender, it is unable to penetrate "hardpan," and is not likely to do well in very rocky or gravelly soil; on the other hand, the root system is vigorous and the feeding roots extend to a distance from the base of the stem equal, approximately, to the height of the plant.

The banana will endure almost any amount of rain providing the drainage is good but any prolonged drought is very likely to check the growth if not stunt the entire "pono," or clump. Cracking of the soil during prolonged dry weather not only allows the slight amount of moisture to evaporate rapidly therefrom but breaks many of the feeding roots of the plant.

Selection of "seed" suckers.—While it is theoretically possible to use the base of any banana stem or even a portion of this for planting, much better results are obtained by using the suckers produced about the old plant. These offsets, ratoons, or, as they are commonly called, suckers, may be divided into three types: Root-buds, or the comparatively small short offsets having only a short growing point at the tip; the common ratoon which may have one or two rather broad leaves at the top of a stem from ½ to 1½ meters high; and, best of all, the "sword" sucker, which has a strong large base gradually tapering to a slender point with one or two very narrow straplike leaves at the tip which may be one meter above the surface of the soil. (Plate II.)

These suckers should, of course, be selected from the most vigorous plants and in no case should they be taken from the vicinity of a "pono" which appears to be diseased or infested with the root-weevil. The suckers should be planted as soon after taking up as possible, although if necessary they may be

kept for several weeks. For long-distance transportation the tops may be cut off, leaving only 10 to 20 centimeters of the stem above the bulb; the cut-back suckers should be thoroughly dried and packed in ventilated boxes or sacks for shipping. If badly cut by careless workmen in digging, the suckers should be "healed over" by drying for a few days before planting.

Planting.—The holes should be dug a week, or better a month, before setting out the suckers; they should be not less than 40 centimeters deep and better 50 or 60 centimeters in most soils. The diameter may be from 50 to 75 centimeters depending upon the size of the sucker and the character of the soil. The hole should be leveled, if the ground is slightly sloping, i. e., earth from the upper should be heaped upon the lower side to form a sort of table and thus prevent "washing" during heavy rains.

The holes should be not less than 3 nor more than 5 meters apart. For most varieties, 4 meters will be found the most economical distance, especially if the plants are to be left in position for three or more years.

The suckers should be set so that the top of the bulb is at least 10 and better 15 centimeters below the soil surface, except in the case of root-buds which should be set so that the tip comes just to the surface. The sucker should, of course, be set vertical, but if halves or entire stem-bases of old plants be used, particularly in the rainy season, these should be laid on the side in order that surplus water may not fill up the spongy tissue of the stem-base and cause rapid decay.

In refilling, earth from the surface soil around the hole should be used, the earth from the bottom being left outside on the lower side of the hole. The earth should not be packed too hard over the base of the young sucker but should be pressed just enough to hold the shoot firm until roots have formed. Loose earth may be heaped up somewhat over the top of the hole to allow for the "settling" of the earth after planting.

Cultivation.—Immediately after setting out the suckers they should be mulched with straw, leaves, or brush to prevent the sun from heating and drying out the soil about the young plants, especially in the dry season; or, if planted in the rainy season, cowpeas or some sort of beans or leguminous vines should be planted rather close about the young plant in order to provide a blanket crop to keep down the growth of cogon and weeds and thus save expense in weeding and hoeing. During the first year after planting, catch crops, such as sweet potatoes, pineapples, maize, or upland rice may be planted between the rows of bana-

nas, provided a clear space of at least 1 meter radius is left around each banana. If no catch crop is planted between the banana rows there should be some sort of a cover crop in evidence to keep down the growth of weeds and grass.

Harvest.—The first bunch of fruits should be mature in about twelve months from planting; some varieties require only ten, while some of the larger or more delicate of the plantains may require eighteen months even with good soil conditions. The time for cutting the bunch must be learned by experience. Most varieties are cut for market while the fruit is still green though, of course, for home use it should ripen on the plant. A rounding of the angles (possessed by nearly all varieties) of the individual fruits indicates that the growth of the fruit is practically complete; as soon as this plumpness of the fruits in the bunch is well marked it may be cut for market, the ripening taking place subsequently either en route or in the storeroom at the market end.

At the time of cutting down the bunch the stem producing it should be felled and chopped into three to five sections which should be placed about the "pono." The custom of allowing the stem which has produced a bunch to remain standing after the harvest is not to be recommended, since in that way certain fungus or bacterial diseases may develop and spread to living stems; the quicker the decay of the spent stem can be accomplished the less the danger from these fungus diseases; contrary to common belief, the sap in the old stem does not feed the daughter shoots.

If the "pono," or clump, has been growing well there will be at the time of cutting the first bunch two or three younger stems nearly ready to fruit; if there are more than four or five, one or two of them should be cut out in order that the strength of the "pono" may not be exhausted in producing too many (probbably small) bunches at the same time. Only the experienced planter will know just how much to reduce the number of main stems in the "pono" and how many small suckers to leave for future fruiting stems; the age of the "pono" in question, of course, makes considerable difference in this matter. In rich soil the life of the "pono" may be four or even six years, whereas in poor soil the planter may be obliged to replant every two or three years.

Packing and shipping.—For shipping short distances the fruit bunches need little or no wrapping, especially if they have been cut quite green; for greater distances dry banana leaves,

straw, or similar materials should be used for wrapping the bunches to prevent bruising and breaking en route. The more valuable dessert varieties may be cut into "hands" and packed in crates or baskets with padding material between the layers of hands. Fruits of the very small varieties may be nearly ripened on the bunch then cut so that each fruit has a small portion of the main peduncle attached to its own base, and then put into small cartons for retail trade.

Fertilizers.—Except in worn-out soils near towns fertilizers are seldom to be recommended. There is no doubt but that ordinary chemical fertilizers containing potash and phosphoric acid with or without nitrates will stimulate growth and productiveness, but the expense for fertilizer unless very carefully applied by an experienced planter will hardly balance the gain in product. If some sort of leguminous cover crop is maintained between the rows and if no grass-root excretions have been allowed to poison the feeding roots of the bananas, the fertility of the soil should be a matter for little worry on the part of the planter.

A compost pit in which all vegetable rubbish, animal manures, etc., can be quickly rotted is unquestionably a valuable feature for a banana plantation. No fresh animal manures should be used directly upon the young plants.

If the soil in the plantation becomes so exhausted after, say, five years that the crops are reduced below the paying point the planter should change the crop; i. e., he should cut down all the bananas and either dig up the roots or else allow some strong-growing cover crop, like Lyon beans, to smother them. After "resting" the land for one or two years in a legume crop he may replant the areas with maize, yams, sweet potatoes, upland rice, vegetables, etc., and then replant with bananas.

Pests and diseases.—The principal insect enemies of bananas in the Philippine Islands are the leaf-roller and the root-borer. The leaf-roller is a small butterfly (*Erionota thrax*) which, although usually kept in check by hymenopterous parasites, occasionally becomes so numerous near the towns that it seriously reduces the vitality of banana plantations. It can, of course, be controlled by hand picking, i. e., cutting off those portions of the leaf containing the rolls of the caterpillars. Poison sprays are practically useless on account of the waxy coating of the banana leaf which does not allow the spray to adhere properly.

The root-weevil (*Cosmopolitus* sp.) grubs in old plantations or near towns are sometimes quite numerous and of course weaken

the plants considerably, even killing the young suckers in bad cases; careful attention to the "seed" plants and an occasional inspection of all suckers set out in a new plantation, however, should avoid most of the danger from this source, the adult weevil preferring to deposit eggs on banana roots near to the point of its own origin, i. e., it does not usually travel to a great distance from the "pono" where it passed the larval stage.

A very serious disease exists in many districts of the Philippines, especially on the Chinese, Hawaiian, or Dwarf banana. This disease attacks the bases of the leaves and terminal portion of the stem, gradually working inward and downward till the entire plant is destroyed. The planter should take prompt measures to check the spread of this disease, should it appear in his plantation, by cutting out and digging up all affected plants and removing them from the plantation.

As a prevention of possible spread of fungus diseases which occasionally attack the older banana leaves it is recommended that all dead leaves in the plantation be burned in small heaps between the rows; the ashes from the leaf piles should be scattered immediately after burning. The stripping off of dead and dying banana leaves is not necessary unless blights or other fungus diseases are known to attack the older leaves in that plantation.

By-products.—Besides the fresh fruits for local market and for the steamer trade, the Philippine planter should not lose sight of the fact that there is already a strong demand in Europe, and a growing demand in the United States, for banana flour, banana meal, banana "chips," plantain "coffee," and banana "figs," or dried bananas. By a series of experiments the planter can determine which of his local varieties are best adapted to these special uses and also at what stage of ripeness the fruit should be handled for the several by-products. Generally speaking, the varieties of the Sabá and Tundoc type will be found preferable for flour; the Cariñosa and Bungulan for "chips," and the Lacatan and Higos types for dried "figs." Fruits of the Tundoc and Sabá types may be allowed to become nearly yellow before drying; those of the Latundan type for grinding into flour should be only beginning to turn yellow, i. e., the pulp should be quite firm at the time of drying. The fruits to be dried and preserved as slices, cubes, or entire fruits should be allowed to ripen almost to the point of decaying before drying.

The true plantains, or Tundocs, although more expensive to produce, are better for general purposes than any of the other

types, in fact even for flour, meal, and "chips," they are considerably superior to the common sorts.

Slices from 3 to 5 millimiters in thickness, cut lengthwise of the fruit, may be dried either in the sun on clean galvanized-iron sheets (provided there is no danger of dust), or in any of the artificial drying ovens, or on the home made double boiler; or, more practical still in most cases, in an oven with trays arranged over some sort of a stove (preferably of the "blue flame" kerosene type).

Vinegar, a kind of "beer," and a wine can readily be made from fermenting ripe bananas.

As an article of diet the plantains, or "cooking bananas," deserve higher rank, considering their nutritiousness and wholesomeness, than almost any other vegetable food in the Tropics. *Raw* bananas, however, are of much less value as human food, and should never be eaten till thoroughly ripe.

Yield.—If the "ponos" are set 4 meters apart there should be 625 per hectare. Each "pono" should give one bunch of fruit at the end of the first year, if good methods have been followed; the 600 bunches should be worth some ₱300, wholesale. The second year the yield should be considerably greater, say, ₱400 to ₱500 in value. The value of the third and fourth year's crops depends very largely upon the kind of soil, the weather, and the planter.

NOTES ON SIAMESE POMELOS.

By H. H. BOYLE, *Assistant Horticulturist.*

The following horticultural notes taken upon a recent trip to the seedless-pomelo plantations of Siam via Hongkong and Saigon may be of interest to the Philippine planters.

During the enforced delay of six days in Hongkong waiting for a steamer to Saigon, the writer availed himself of the opportunity to become thoroughly acquainted with the economic plant collection in the Botanic Garden and to visit the environs of Kowloon. Mr. F. P. de V. Soares, a collaborator of the Bureau of Agriculture for the past two years, was instrumental in putting the writer in touch with some of the planters in the vicinity of Kowloon and from them was secured a collection of bananas, several very interesting terrestrial orchids, a variety of yams, taros, and the edible rush (*Eleocharis*). The agronomy of the Chinese farmers was rather disappointing as to modern methods, especially in growing cotton, peanuts, cowpeas, etc. The same observation applies to the Chinese litchi and pear orchards; nowhere were there in evidence straight rows or properly pruned trees. Raising catch crops between the rows of trees was almost impossible on account of the hit-or-miss system of planting. Insects and plant diseases seem to have full sway, no apparent attempt being made to hold either in check; however, no very serious pests or diseases were noticed at the time of the visit.

After the delay in Hongkong passage was taken on a small steamer arriving a few days later in Saigon. Here were found beautiful broad avenues, splendidly planted with native and introduced shade trees which were kept in excellent condition. The principal avenue trees are the dark-leaved tamarind, which seems to withstand considerable pruning, and the majestic rapid-growing teak. Almost every residence of any pretensions whatever is situated within a well-kept garden with a fine display of ornamentals.

The Botanic Garden is a first-class and well-equipped institution, which repays the traveler's thorough inspection. It con-

tains over 75 hectares of ground, well laid out with walks and drives such as the French landscape gardeners have long been famous for. All trees, shrubs, and plants are grouped in botanical order and are properly labeled and well cared for. The five days passed in these gardens were very well spent indeed. Through the kindness of the Gardens' very able director, M. Morange, several collections of economic plants were made up for shipping back to the Bureau of Agriculture. The principal economics obtained during this visit were varieties of sugar cane, cassava, vanilla, bananas, and citrus fruits; six varieties of the latter class promise to be very valuable introductions and the Philippine planter is fortunate in getting some of these types of oranges, pomelos, limes, tangerines, etc., which are, in the writer's opinion, quite new to the Philippine Archipelago. Three species of these citrus (*C. madurensis, C. digitata,* and a fruit known locally as "Citronne de la Nestour") are of particular interest to the hybridizer. The experimental section of the Saigon Botanic Garden contains some six hectares and is managed along very up-to-date methods. With the exception of the Bureau of Agriculture fruit station at Lamao there is probably no better-planned testing station, with the possible exception of Buitenzorg and the Japanese stations, east of India. All plants whether grown for test or stock are grown in beds 1 meter wide by 15 meters long, with paths one-half meter wide between the beds. Here were seen under test 34 varieties of sugar cane, 11 of these being either native or hybrids. The collection of bananas, while not to be compared with that of the Bureau of Agriculture, is very interesting, containing as it does varieties from Madagascar, Reunion, Java, and the West Indies with the indigenous sorts. A number of interesting mango species and varieties were also noted and arrangements were made with the Director of the Botanic Gardens for shipping plants of each variety to the Bureau in the near future. This Garden is well provided with all the accessories requisite for the scientific propagation of economic plants, such as two iron and brick greenhouses, one large plant shed of iron framework, an orchid house, sun house, seed house, storerooms, and a rubber-plant house.

About September 5 the writer left Saigon on a small steamer and after a very rough voyage around the Cochin-China Peninsula arrived on September 9 in Bangkok. The vice-minister of the interior, Phya Ama Amat, very kindly detailed one of his secretaries to accompany the writer to the various private estates and plantations where the famous seedless pomelos and other

plants of value might be obtained; he also furnished a launch for making the longer trips into the interior. The vice-minister expressed his keen interest in the writer's work and his desire to assist in every way possible, stating that he had very pleasant memories of the treatment he received from Dr. A. R. Ward and other officials when he visited the Philippines two years ago to investigate animal diseases. He was asked to what extent rinderpest was now present in Siam and he stated that they had succeeded in eradicating this disease by the segregation method recommended by Dr. Ward; he spoke of himself as a pupil of Dr. Ward and was highly enthusiastic over the rinderpest work.

On the following day a visit was made to the gardens of Prince Yugelar, situated some 50 kilometers from Bangkok and here for the first time the writer saw the Siamese seedless pomelos growing in plantation form. Here a fine orchard of Pulasan (*Nephelium mutabile*) was found; all the trees are propagated by marcottage, budding and grafting being unknown arts in Siam. The flavor of some of the varieties was delicious and many trees produce seedless fruit. Seeds and plants from this orchard were brought to Manila. Prince Yugelar also presented a very interesting collection of bananas (some 20 varieties) to the Bureau.

On September 12, accompanied by Koon Pisit, the writer visited the town of Phra Patom, where the largest pagoda in Siam is located. Around this pagoda were found a number of interesting fruit trees, such as the Bhel (*Aegle marmelos*), Pulasan, and pomelos. Near this town are the pineapple plantations, owned in most cases by Chinese planters; the methods of cultivation are as crude here as in the Kowloon district. The quality of the fruit, however, was medium. In Phra Patom market were found a number of very interesting vegetable and fruit varieties new to the Philippines; among these was a species of *Solanum*—a vegetable related to the tomato and eggplant—several taros, a fruit apparently related to the Santol, and several unidentified fruits.

On September 13 the writer proceeded to the Nakoi Chisii district where the finest pomelo orchards are located. The largest of these was owned by a Chinese planter and contained about 20 hectares, three-fourths of which was planted with pomelos of the "seed" variety, while some 25 per cent of the area contained "seedless" trees. The orchard is divided into plats some 7 meters wide by 60 to 90 meters long, separated by trenches some 3 to 4 meters wide by 2½ meters deep. The

pomelo trees are planted in single rows on these plats. All trees are propagated by marcottage, or the "don" method. The writer was able to demonstrate the modern methods of buddage and through the assistance of Koon Pisit explained each step so that, were it not for the deeply inculcated custom in vogue there, the planters would now be able to propagate their trees much more rapidly and economically. The soil of this orchard contains about 60 per cent clay.

The first fruits examined in the "seedless" section proved to be full of seeds. Upon inquiry as to the reason for this it was stated that the seedlessness was due to the salt deposited from the brackish water which backs up into the river during the dry season; the planters also said that a coconut shell of salt was placed in the hole at the time of transplanting the tree and that another shellful was given the tree each year. Being unable to give full credence to these stories the writer began a thorough investigation of the trees in the "seedless" section, cutting open fruits from widely separated points on each tree and gradually arrived at what is believed to be the true explanation of this phenomenon: all, or nearly all, trees in the so-called "seedless" section are the genuine seedless type and are not self-fertile; i. e., in order to produce seeds the flower must be pollenated with pollen from the "seed" trees in the near vicinity. In some striking cases the fruits on a "seedless" tree were found to be free from seeds on all branches of the tree except those on the side nearest to a "seed" tree, the pollen from the latter having apparently been carried across by insects or borne by the wind to the "seedless" flowers. Generous quantities of budwood were secured, of course, from the best types of these seedless pomelos. Having the very great advantage of being able to personally test the flavor, texture, etc., of the fruits from each tree, the writer was thus sure of obtaining the types which in his opinion are the best of these genuine seedless sorts, which are without question the finest pomelos in the world. To make doubly sure arrangements were made to have "dons" propagated by marcottage and forwarded to Manila as soon as they are in good condition. Photographs of the principal trees and fruits and views in the orchard to show the peculiar method of drainage and the plat system are now on file in the division of horticulture.

On the 14th of September a visit was made to the plantations of Dr. Yai Sanitwongse who furnished the seedless pomelo budwood presented to the Bureau of Agriculture by Mr. C. A. Steele in 1912. In these plantations there were obtained an interest-

ing lime, several varieties of mangos, and a collection of ornamentals which will be of much interest in the Philippines. One crop, the betel-nut palm, seemed to be given very special attention in all the districts visited; as it is the habit, or rather custom, for everyone to chew betel in Siam there is, of course, good reason for this extensive and intensive culture. (Plate VIII.)

Before leaving Siam, the bureau of agriculture was visited, and here the director and his adviser, Mr. Graham, were met. The director very kindly presented a collection of bananas containing some 32 named sorts nearly all of which appeared to be different from those presented by Prince Yugelar. There were also obtained three varieties of coconuts, several pineapples, and 18 plants which have not been identified thus far.

The Dusit Park consisted of some 50 hectares of land with well laid-out walks and drives and contains a splendid variety of ornamentals and native shade trees. On September 16 after a very interesting week in the "Land of the White Elephant," the writer embarked for Singapore, arriving in that city the 21st. The famous Botanic Gardens were, of course, visited at the first opportunity and with the director, Mr. I. H. Burkhill, considerable time was spent in studying the wonderful collection of plants from the Tropics of both hemispheres. The Gardens consist of about 80 hectares of land including the experimental rubber plantation which contains the oldest Pará rubber tree in the Far East. The director made up a generous collection of economic plants for the writer to take back to Manila and it was arranged that roots of each of the Philippine varieties of yams should be sent in January to Mr. Burkhill, who is a recognized authority on the Dioscoreaceæ. Among the interesting plants presented by the director are nutmeg, kola, Zanzibar coffee, three new varieties of pineapples, *Boehmeria,* Pulasan (*Nephelium mutabile*) and some interesting species of *Eugenia, Artocarpus, Garcinia, Sandoricum,* and others, some 29 varieties in all; these plants are now being propagated at the Singalong and Lamao experiment stations.

As soon as possible after packing up these plants the writer took a cargo boat to Iloilo, and arrived in Manila October 5.

THE ATEMOYA, A NEW FRUIT FOR THE TROPICS.

By P. J. WESTER, *Horticulturist in Charge of Lamao Experiment Station.*

The acquaintance of the writer with the annonas dates from 1898, when he first sampled the sugarapple (*Annona squamosa* L.) in Florida, but more intimately since 1904, when he first attempted to utilize the mamon (*A. glabra* L.) as a stock for the cherimoya (*A. cherimolia* Mill.). The cherimoya had hitherto failed on its own roots in south Florida, but it flourished grafted upon its vigorous relative.

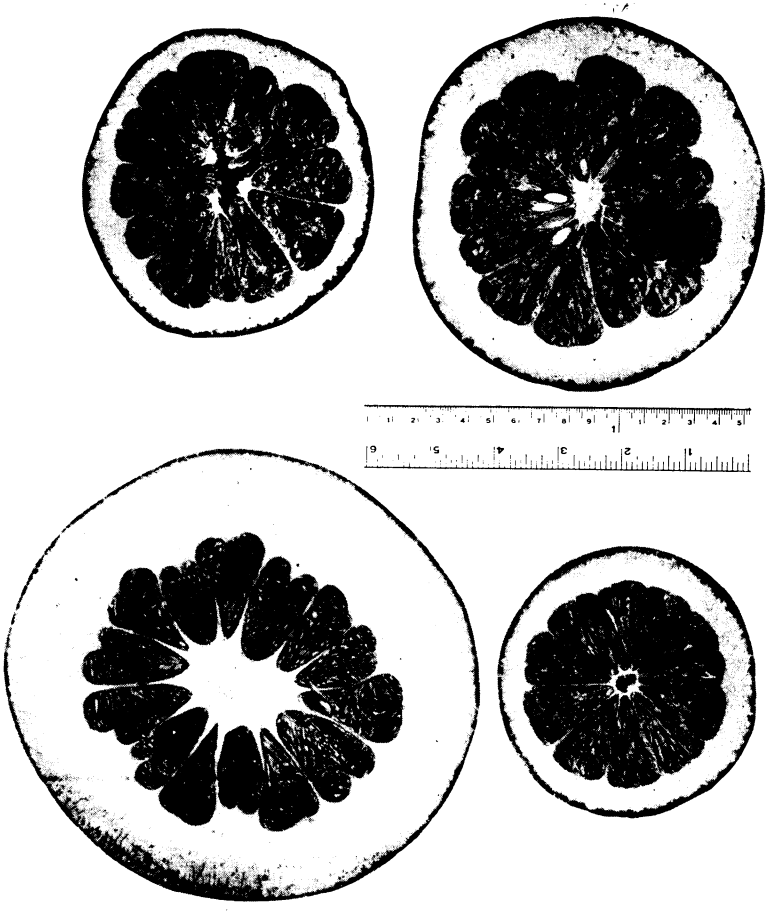
However, when the plant came into bloom it failed to set fruit, and this led the writer to investigate the reason for sterility, with the result that the entomophilous and proterogynous characters of the flowers of this and related species was discovered.[1]

In the course of the pollination experiments that subsequently were carried on in connection with the study of the flowers, the sugarapple and the cherimoya were hybridized.

In coming to the Philippines, the writer brought with him a few seeds thus obtained, which were sown in March, 1911. The resultant hybrids made a most remarkable growth, seemingly having the combined vigor of both parents, and some plants attained a height of 2.3 meters in one year, and blossomed at the age of 16 months. (Plate IX.) The progress of the reorganization work at the Lamao experiment station, where the hybrids are growing, has twice necessitated transplantation of some, notwithstanding which they have made a most satisfactory growth. Because of the cutting back of the plants attendant upon their transplanting, practically no flowers appeared, and no fruits were expected this year. The blossoming season of the cherimoya is somewhat in advance of that of the custard-apple, but owing perhaps in part to the shock and retardation due to the transplanting, a few flowers appeared in June on

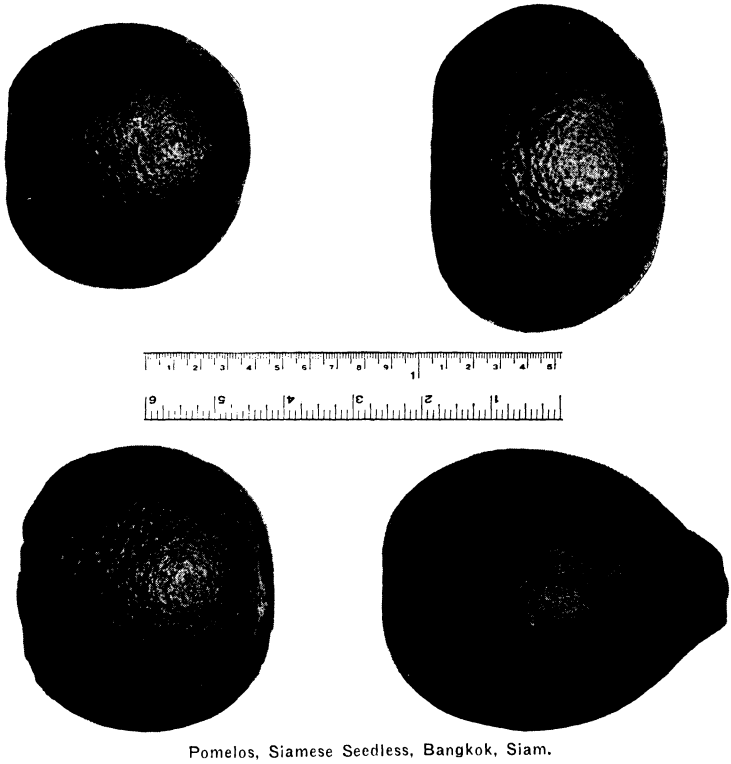
[1] Wester, P. J.: Pollination Experiments with Annonas. Bul. Torrey Bot. Club, 37: 529–539. 1910.

Types of banana suckers: (*a*) Root-bud; (*b*) "palma;" (*c*) "sword."



Pomelo, Siamese Seedless, Bangkok, Siam.

Three seedless and one semiseedless type. Largest, red fleshed, bitter.



Pomelos, Siamese Seedless, Bangkok, Siam.

Pulasan (*Nephelium mutabile*), Prince Yugelar's estate, Bangkok, Siam.

Entire orchard propagated by marcottage; trenches 6 feet deep through grove. Seedless fruits sometimes found. Single fruit worth three centavos each, locally.

Durian (*Durio zibethinus*) showing method of planting for protection from white ants.

Trench 60 centimeters wide at about 1⅔ meters from the trunk for drainage. Tree originally planted on bed of vegetable trash covered with earth to insure liberal supply of air to the roots. Bangkok, Siam.

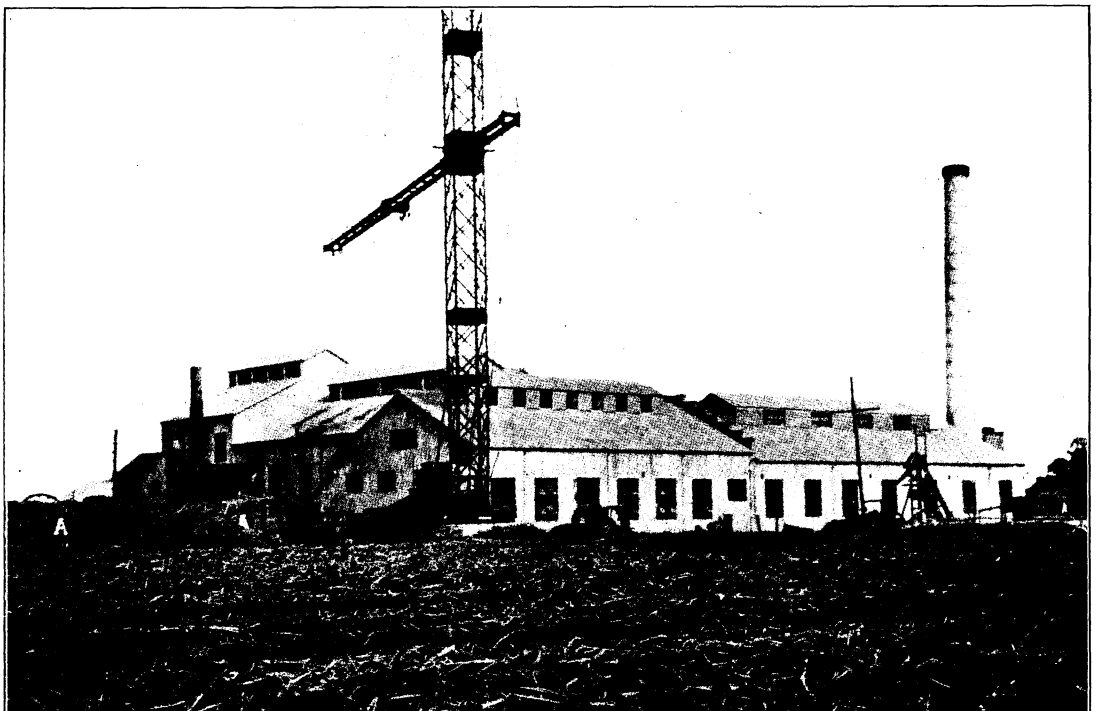
Mangosteen orchard, Singapore.

Bunga (*Areca catechu*) plantation, Nakoi Chisii district, Siam.

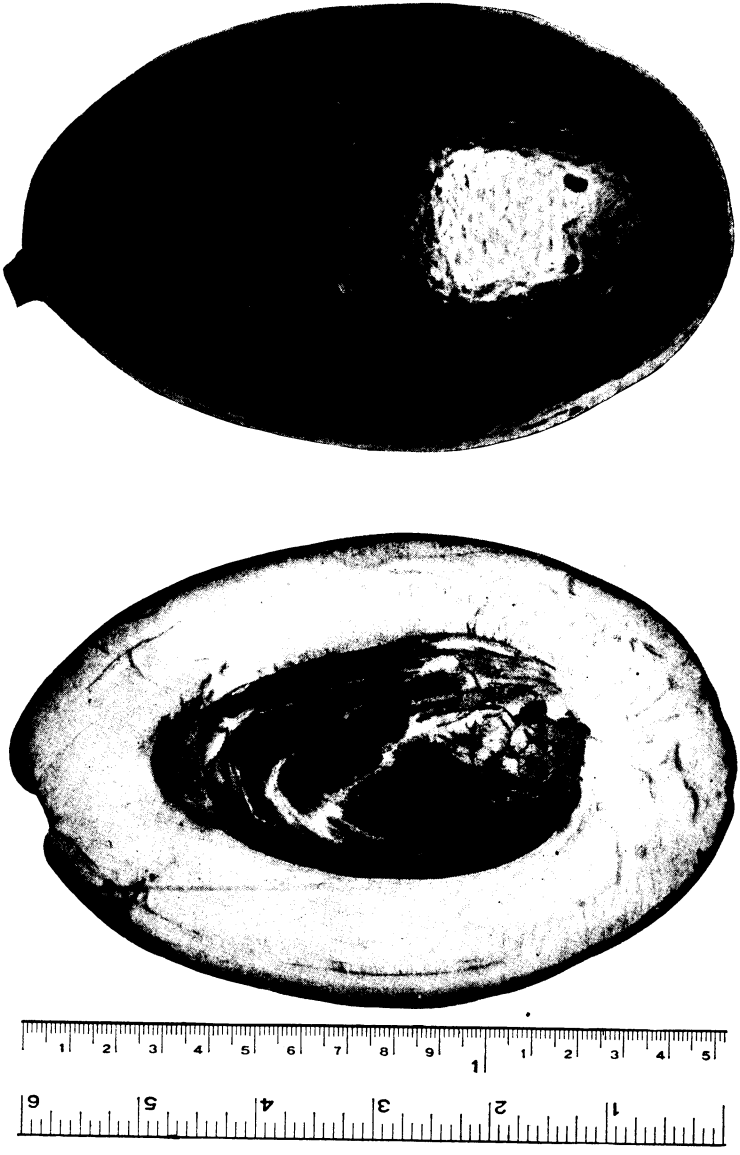
Trees about two meters apart. The betel-nut industry is of the highest importance in Siam, the habit of chewing this being universal.

Atemoya, at the Lamao experiment station, one and one-half years from seed.

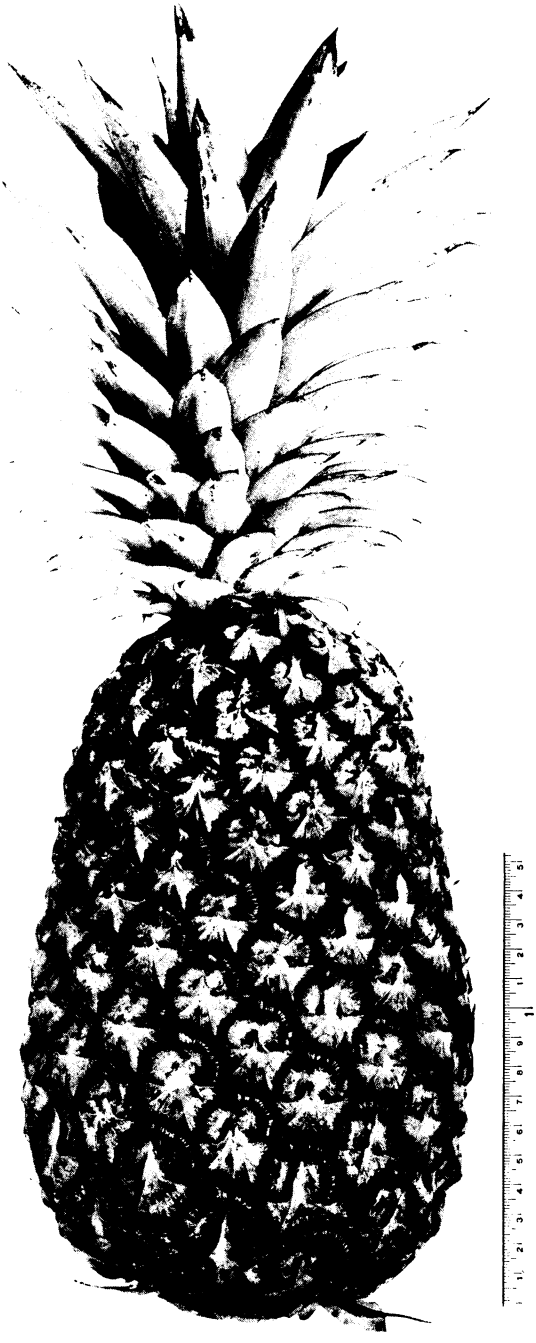
A typical sugar mill of the Philippine Islands. Occidental Negros.



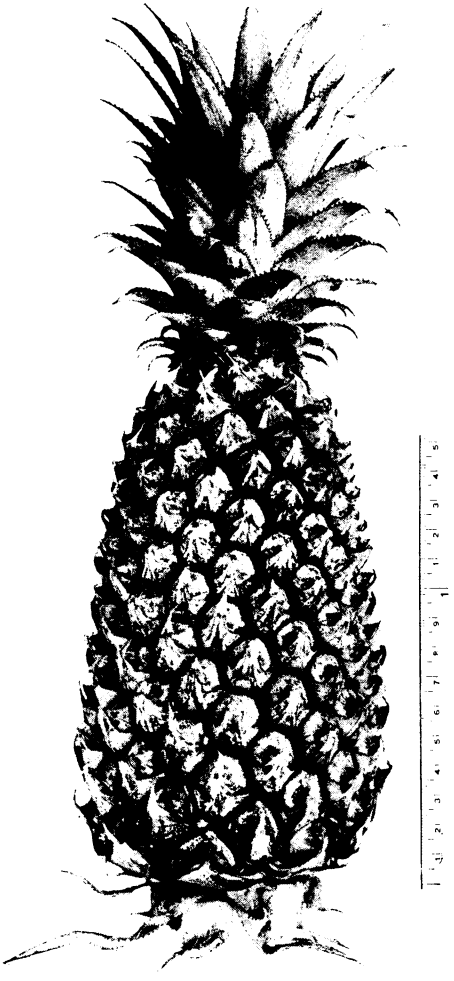
A modern sugar house of Louisiana where an extraction of 84 per cent juice of cane is secured.



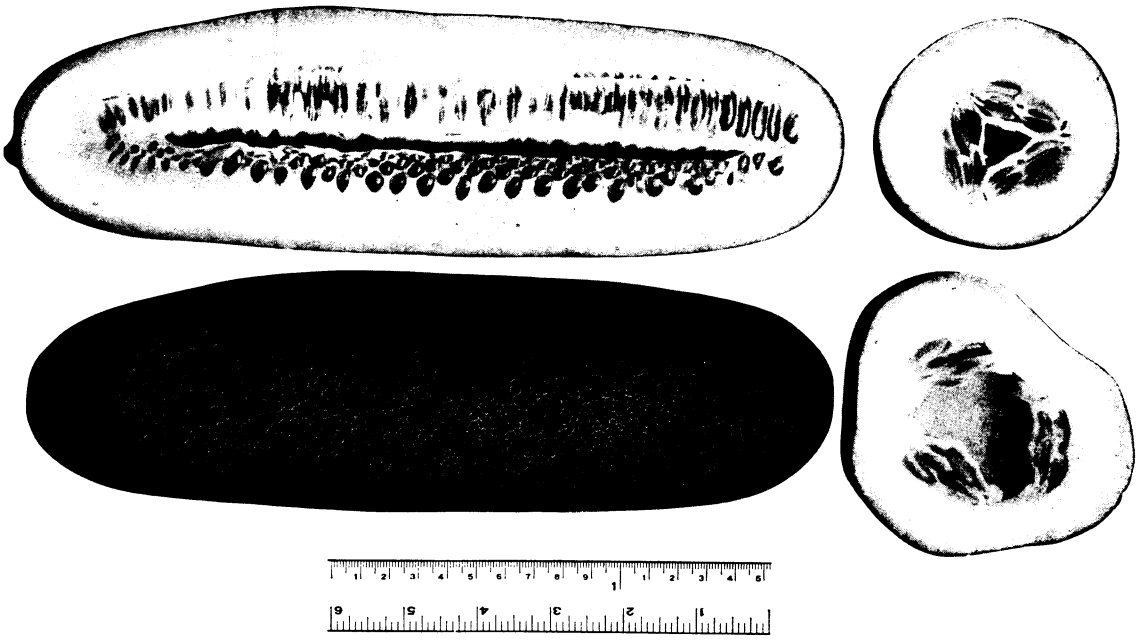
The Lyon Avocado grown at Lamao experiment station.



Cayenne pineapple, grown at Lamao experiment station.



Queen pineapple, grown at Lamao experiment station.



The India cucumber grown at Lamao experiment station.

one of the transplanted hybrids. One of these was pollinated with pollen from the custardapple (*A. reticulata* L.), with the result that it set, and a fruit developed and ripened October 8.

The following is a description of the fruit: Size small; weight 280 grams; length 7.7 centimeters, equatorial diameter 7.6 centimeters; cordiform in shape, with prominent carpels and distinct areoles; exterior yellowish green, almost glabrous; skin very thick and tough; flesh white, tender, and melting, with a slight trace of fiber, juicy, subacid, rich and aromatic; flavor excellent, very similar to a good cherimoya with a dash of the delicate sweetness of the sugarapple; seeds 4 to 7, similar in shape to cherimoya seed but darker colored.

The fruit is rather small but regular and well shaped, about the size of a sugarapple, which was to be expected considering that the father parent, the cherimoya, was also undersized. With the employment of large-fruited cherimoyas for the breeding work we may also anticipate a progeny with larger fruits. The "Giant" cherimoya has been imported by the Bureau from Australia and will be used in the annona breeding work as rapidly as the plants become of age. A number of choice varieties have also been presented to the Bureau by Mr. David Fairchild, agricultural explorer in charge of the office of foreign seed and plant introduction, Bureau of Plant Industry, United States Department of Agriculture, which will be similarly employed.

The atemoya plants, of which there are 23 that have not yet fruited, are very similar in appearance to the cherimoya, and the fruit is also practically identical with the prominent-carpelled cherimoyas.

Superior to the sugarapple, it is not claimed that the atemoya is an improvement upon the cherimoya; but, as pointed out in a previous issue of the Review, it has been hoped that by crossing the cherimoya with the sugarapple the excellent flavor of the subtropical cherimoya, which does not succeed well in the low altitudes near the equator, might be imparted to the progeny, and that the other parent from the lowlands would impart to it adaptability to a tropical climate. It would seem that this anticipation has been realized in the above instance.

The seedlings that are being propagated from the fruit described above are of course one-half custardapple and a quarter each cherimoya and sugarapple. It will be exceedingly interesting to watch the results of this new combination and the new hybrids will be forced to fruit as rapidly as possible.

The name "atemoya," which is here being proposed for this new race of fruits, is derived from a combination of one of the old original names of the sugarapple, *Ate pannicensis,* quoted from Hernandez, in his work "Nova Plantarum Animalium et Mineralium Mexicanorum Historia," published in 1651, and cherimoya.

As far as material permits, the new fruit is being propagated for distribution throughout the Philippines.

SUGAR MANUFACTURE.

THE MODERN METHOD vs. THE OLD.

By CLEVE W. HINES, *Station Superintendent.*

There is no industry in the Philippine Islands possessing greater future possibilities than that of cane sugar. Every advantage is offered in the way of rich soils, a tropical climate with a rainy season during the main growing period, and a dry season during a good part of the harvest period.

The industry might, however, be said to be only in its infancy. While there are numerous small antiquated mills scattered over the islands, but few strictly modern mills are found in operation to-day. Several, however, with efficient crushing plants are doing excellent work, and one under construction, the Calamba factory, will be equal to the modern factories of Hawaii and Louisiana.

A number of attempts have been made to modernize some of the native factories by the addition of improved crushing apparatus, boiling plants, and occasionally centrifugals, each of which is a step in the right direction.

Crushing plants are found in the various sugar houses with results ranging from 55 to 84 per cent juice on cane. One may readily realize what a great loss is encountered to the manufacturer if even as low an extraction as 65 per cent is attained. A typical example will illustrate this. Here 650 kilos of juice are received from each ton of cane. This juice with a sucrose of 15.2 per cent gives 98.8 kilos of sucrose in juice recovered from each ton of cane. A modern mill with an extraction of 84 per cent will give 840 pounds of juice with a sucrose of 15.1 per cent. (The last juice extracted from cane gives a lower sucrose and purity than the first.) This will give 126.8 pounds of sucrose from each ton. This difference will amount to 29.1 kilos of 96° test sugar valued at ₱3.48.

The bagasse from the latter mill will have a much higher fuel value than the former because of the lower moisture content. One kilo of bagasse with a moisture content of 56 per cent has a heat value of 65,494 B. t. u., while a kilo with a moisture con-

tent of 44 per cent has a value of 90,882 B. t. u. These seem like enormous losses encountered by some of the smaller sugar houses, yet they have little comparison with many of the other losses throughout the plant.

After the juice leaves the rolls it is strained to remove any particles of bagasse and other foreign matter.

Sulphuring of the juice.—The juice is now subjucted to a sulphuring process which has a fourfold purpose. It removes some impurities, increases the acidity of the juice so that a greater quantity of lime may be added which precipitates impurities not removed by the sulphur, decolorizes or bleaches the organic nonsugars, and acts, to a certain extent, as a preservative. Juices should always be sulphured in the cold for two reasons: First, sulphurous acid at high temperatures would destroy by inversion an undesirable quantity of sugar; secondly, some sulphuric is likely to be formed which is much more active than the former. It may be well to mention the chemistry of this process.

S (sulphur) + O (oxygen + heat) $=SO_2$ (sulphur dioxide)

This sulphur dioxide is the real bleaching agent sought. When it is dissolved in water in the cold we have the following result:

SO_2 (sulphur dioxide) + H_2O (water) = H_2SO_3 (sulphurous acid).

But when heated to a high temperature we have the following result:

SO_2 (sulphur dioxide) + H_2O (steam) + O (free oxygen) = H_2SO_4 (sulphuric acid).

This sulphuric acid is the dangerous chemical in sugar-house work, but is only formed when high temperatures are used during sulphuring. The pipe carrying the sulphur fumes from the burner should be surrounded by a larger pipe filled with cool water to prevent the fumes from leaving at too high a temperature.

It may very readily be seen what an important rôle this sulphuring process plays in sugar-house work, and yet it is astonishing what little attention it oftentimes receives. Too many sugar houses are run without a definite knowledge of what is going on in each process of the work.

The writer was recently requested to examine certain products in a sugar house where poor results were being attained. Analyses showed the normal juice to have an acidity of 1. cubic centimeter to N/10 NaOH using phenolphthalein as an indicator. The sulphured juice was turned out with an acidity of 1.1 cubic

centimeters which meant that little or no sulphur fumes had entered the juice.

The liming process.—Immediately following the sulphuring of the juice comes the liming process. This requires even more skill than the former. In many factories expert clarifying men do nothing but attend to this part of the work.

Milk of lime is usually used and is made by dissolving quicklime in water:

$$CaO \text{ (quick lime)} + H_2O \text{ (water)} = Ca(OH)_2 \text{ (calcium hydroxide.)}$$

This should be made up to a certain density gauged by a Baumé spindle. About 15° Baumé is ordinarily the most satisfactory density to use.

The first action of the lime is to neutralize the organic and inorganic acids; it then coagulates some albumins and albuminoids, throws down insoluble lime salts in the form of sulphates, phosphates and carbonates, and the bases, iron and aluminum. These heavier compounds act as mechanical precipitants bringing down with them other impurities. These are removed at the bottom of the settling tanks and are sent to the filter process. The lighter substances including such material as fiber, wax, etc., float to the top in the form of a flocculant precipitate and are removed in the form of a "blanket."

Methods of judging the correct amount of lime.—There are two methods of judging the correct amount of lime to use. First, the chemical method as follows: 10 cubic centimeters of the juice are titrated against a standard acid using phenolphthalein or litmus as an indicator. It is not safe to lime beyond the neutral point. It is usually best to leave the juice slightly acid (about 0.2 cubic centimeter or 0.3 cubic centimeter in order to be on the safe side). The second method is one where the experienced operator judges by the color of the juice, the rate of precipitation, etc.

The former method gives more accurate results and can be absolutely relied upon.

Evil effects or overliming.—As stated before it is never safe to carry liming beyond neutrality. At this point all the precipitable impurities are removed and any excess of lime added will result in the destruction of the reducing sugars and the formation of soluble lime compounds of organic acids which impart a very dark color to the juice and will later decompose into acid substances causing inversion of the sucrose.

The lime salts also increase the viscosity of the massecuites

thus retarding evaporation and crystallization. These dark-colored massecuites can only give a low yield of an inferior sugar with an excessive amount of molasses. These lime salts may be partly removed by the use of phosphoric acid. While this may improve conditions to a certain extent it does not remove the glucinic acid which has been liberated and must continue to impart the dark color.

A factory recently visited had a good mill and fairly modern equipment throughout the house. The cane received was of the very finest type of Hawaiian and native mixed. The juice was in good condition until it reached the liming tank. Here it was limed to 0.4 cubic centimeter alkalinity and heated to 100° C. It immediately turned dark and exhibited all the evil effects of an overlimed juice. Phosphoric acid was then added until an acidity of from 0.7 cubic centimeter to 1 cubic centimeter was reached. During the process of evaporation these lime salts continued to decompose, increasing the already acid juice and causing a destruction of sucrose by inversion which gave an excessive amount of molasses that was of necessity turned out with a high purity since the large amount of invert sugar and lime salts prevented the crystallization of the sucrose. This final molasses with a purity of 52 was being sold for 16 centavos per gallon which was a small fraction of its sucrose value, were it possible to recover same. A slight change in the sulphuring of this plant with a reduction of the liming to 0.3 cubic centimeter acidity gave a beautiful straw-colored juice which precipitated well and gave a clear juice with a minimum of lime salts for the evaporators. The massecuite resulting from this juice was equal to many the writer has seen in Louisiana and Porto Rico where a much more elaborate process was used. The sugar was very readily washed to a yellow clarified grade and placed directly on the market for immediate consumption.

FOUR PROMISING PLANT IMMIGRANTS.

By P. J. WESTER, *Horticulturist in Charge of Lamao Experiment Station.*

Not a few people question whether the expense incurred in the importation of new plants is justified by the results obtained. As in any other enterprise, unwisely directed, the profit and loss may of course show up on the wrong side of the ledger, but this should be charged against him who directs it and not against the work itself.

Ever since the organization of the Insular Bureau of Agriculture plant introduction has played a more or less important rôle in the activities of the Bureau, and a short review of this work up to May, 1912, appeared in the Review, Vol. V, No. 7. Since that time plant-introduction work has grown apace and no mail steamer arrives in Manila nowadays without carrying its quota of plant material for the Bureau of Agriculture.

While considerable expense has been incurred in the importation of some plants, a large proportion of new material is bought from dealers in foreign countries at current prices, and a very considerable share is obtained from public institutions and private collectors in exchange for Philippine plant material, and in this instance practically the only expense is the packing and postage.

Including the economic plant introduction, vegetable, and ornamental lists the records show 3,635, 1,370, and 1,997 accession numbers, respectively, at the date of writing (October 20, 1913).

No one familiar with the subject expects all or even a large percentage of new plant immigrants to succeed, and as a matter of fact a very large proportion are eliminated in the early trials. A small minority survives and from these a few finally prove sufficiently valuable to the country to pay for the cost of the importation of these and of the less fortunate introductions.

Among those importations that in the trials of the Bureau at the Lamao experiment station have appeared sufficiently promising to merit space in the Review are the Lyon avocado, the (smooth) Cayenne and Queen pineapples, and the India Cucumber.

THE LYON AVOCADO.

(Plate XII.)

Description.—Size large; average weight 800 grams, of which 86 per cent is edible; form oblong oval; surface smooth; color green; lenticels fairly numerous, whitish, irregular; skin thick and brittle, separating readily from the flesh; flesh pale, creamy yellow, tinged with green near the skin, buttery and nutty, containing few fibers; flavor and quality good; seed very small, oblong, nearly filling cavity, seedcoat readily separating from flesh; season, late July and early August.

While there are no written records available, there would seem to be no doubt but that the tree sprang from seed imported in 1903 by the then horticulturist of the Bureau, Mr. W. S. Lyon. The tree has been of rather weak growth, and if the surmised date of importation is correct, it has been slow in coming into fruiting. The tree bore a good maiden crop of fruit considering its size, which ripened on the tree in the height of the rainy season, contrary to the fruit on nearly all the avocados in bearing at the Lamao experiment station this year, which split and dropped before attaining maturity. If this character is permanently inherent in this variety it will add greatly to its value. The variety has been named Lyon in honor of its introducer into the Philippines and is being propagated for general distribution throughout the Archipelago.

THE CAYENNE PINEAPPLE.

(Plate XIII.)

Description.—Size large; average weight 3 to 2.75 kilograms; form oblong, slightly conical, truncate; color brownish yellow; eyes medium large, not prominent, medium deep; flesh yellowish, very juicy, rich, sweet and yet sprightly acid, somewhat fibrous, very aromatic; flavor and quality excellent; core rather large, inedible; crown comparatively small.

If it did not originate there, it is highly probable, when its name is considered, that the Cayenne pineapple became horticulturally prominent first in Cayenne in French Guiana. Because of the practical absence of spines on the leaves the variety is nearly always referred to as "smooth" Cayenne.

The Cayenne is unexcelled as a canning fruit, and is for this purpose extensively cultivated in Hawaii and Singapore. It is also largely grown in Australia and Jamaica, and other parts of the West Indies. The Cayenne has not the keeping and ship-

ping qualities of some other pineapple varieties, notably the Spanish, and is therefore not suitable for long-distance shipment in the fresh state. Carefully handled it can unquestionably be grown for export to Hongkong and possibly to the Chinese ports.

As far as the writer is aware the Cayenne was first introduced into the Philippines in 1911 by Mr. Weston of Manila. A second importation was made the same year by Castle Bros., Wolf & Son, and a third by the Luzon Pineapple Plantation Company. Upon the recommendation of the writer, the Bureau of Agriculture procured 2,000 plants of Cayenne from Hawaii in May, 1912, to be used in demonstration and distribution work.

THE QUEEN PINEAPPLE.

(Plate XIV.)

Description.—Size small to medium; weight averaging from 1 to 1.5 kilograms; form oblong, slightly tapering, almost rectangular in outline in larger specimens; color straw yellow with brown markings; eyes rather prominent, small and deep; dorsal scale very long, spiny; flesh yellowish, tender, juicy, sweet, rich, somewhat less aromatic than Cayenne but decidedly sweeter than that variety; flavor and quality excellent; core comparatively small, with fair edibility; crown small to medium.

The Queen is more tender and sweet than the Cayenne, and has a distinct agreeable flavor that in the fresh state will make it preferable to that variety, but in the Philippines Queen seems to be somewhat affected with eyerot when it ripens during the rainy season. The plant is of strong and vigorous growth though somewhat dwarfer than the Cayenne, and has broad spiny leaves. The Queen is propagated almost exclusively from suckers, which are produced in abundance; the slips are very rare and small.

The Queen pineapples now at Lamao number some 1,000 plants. Part of these descend from an importation of plants made by the Bureau from Durban, South Africa, under the name "Natal Canning," probably in 1905 or 1906, for a few were reported to have fruited in 1907. Another part has probably been imported from Hawaii since one lot of the plants has been referred to as "Hawaiian pineapple" by previous superintendents of the Lamao experiment station.

In Florida and the West Indies the variety under discussion is generally known as the "Egyptian Queen" and "Natal" but its original name is supposed to be "Cleopatra," according to Hume.

The pineapples at Lamao are set out according to the narrow-

bed system used in the pineapple plantations in Florida, and described in circular No. 16, of this Bureau. That is, the plants are set out in long rectangular beds containing six rows of plants set 60 centimeters apart each way. Paths are provided for by leaving two rows vacant between each two beds from which to perform any labor necessary in connection with the cultivation of the plants. The advantages derived from this close planting is that more plants can be set on a hectare than if wider spacing is used; furthermore, the plants brace each other and there is in consequence little or no loss of fruit from sunscald; finally much of the cultivation expense is eliminated, for the closely set plants aid in choking out the weeds, and the shading of the ground prevents excessive water evaporation from the land.

In order that this system of planting may be successful it is essential that the land be thoroughly prepared and that it be freed from such pernicious weeds as nut grass and cogon before the setting out of the plants.

The present outlook for the successful culture of pineapples in the Philippines is very bright.

THE INDIA CUCUMBER.

(Plate XV.)

Description.—Size large, 22 to 30 centimeters long, averaging 26 centimeters in circumference; average weight 850 grams; form oblong, cross section more or less triangulate; color brown, the surface cracking as the cucumber attains maturity, exposing the flesh and giving it the appearance of being reticulated; surface fairly smooth; flesh perhaps somewhat less tender than the standard cucumbers of the Temperate Zone, nevertheless very good; seed abundant.

The seed of this variety was presented to the Bureau of Agriculture by Mr. A. C. Hartless, superintendent of the Saharanpur Botanical Garden, United Province, India, in 1911, and was sown at the end of the rainy season the same year at the Lamao experiment station. From the seed saved another sowing was made in January, 1913, together with a large number of imported varieties of cucurbits of all classes. In this trial the India showed itself hardier and superior to all the cucurbits planted in the resistance to insect pests, which practically destroyed the rest notwithstanding frequent applications of arsenical sprays. The variety is of vigorous growth and a satisfactory yielder and is unquestionably one of the best varieties adapted to local conditions, everything taken into consideration, that has been introduced into the Philippines.

A large area has lately been planted to India at the Lamao experiment station with a view of producing seeds for general distribution throughout the Philippines another year.

India is the original home of the cucumber, and the variety under consideration seems to be an improvement upon the aboriginal form that is especially adapted to tropical conditions.

According to Mr. Hartless this cucumber is grown throughout India as a climber during the rainy season. Notwithstanding its extensive cultivation in India it is a curious fact that this distinct cucumber variety has never received a variety name. Coincident to its wide dissemination throughout the Philippines it has therefore been considered expedient to christen the variety in order to distinguish it from other varieties, and it has been named "India" in honor of the ancestral home of the cucumber.

CURRENT NOTES—FEBRUARY.

NOTES by O. W. BARRETT, Chief, Division of Horticulture.

[From the Daily Consular and Trade Reports of the United States Department of Commerce.]

PINEAPPLES IN FORMOSA.

Pineapple growing in Formosa is developing rapidly. The Hozan Pineapple Cannery Company has put up 360,000 cans in the season which has just ended; this is about double the previous season's output; the company has consequently declared an 8 per cent dividend.

FISH GUANO.

Throughout the world fish guano is coming into commercial prominence as a cheap crop fertilizer. Norway exported during the first half of 1913 no less than 4,500 tons of this material.

RUBBER IN THE FEDERATED MALAY STATES.

The Federated Malay States are now producing about one-half the world's total output of plantation rubber. There are now a little over 700 estates in that country and new land is still being opened up, though by no means so rapidly as in 1910 and 1911. The average yield per acre for 1912 was 100 kilos. The recent disheartening drop in price has rather exceeded the fears of the planters who were, of course, expecting that the high prices obtaining in 1910 and 1911 could not be maintained. The present price per kilo, it seems, is only about ₱2.40 for good plantation product, or less than half the price obtained during the "boom" period.

COCONUTS.

Coconut planting is rapidly gaining in favor and prices are very satisfactory, copra having advanced considerably in value; the area in coconuts in the Federated Malay States is estimated at about 63,000 hectares (157,600 acres), the area in the Philippine Islands being roughly between 220,000 and 250,000 hectares.

COPRA.

Copra shipments from Java, and in fact from all of the Dutch East Indies, are steadily increasing; in 1912 Java alone supplied more than 100,000 tons of copra valued at over 15 million pesos.

The total copra export of Dutch East Indies will probably amount to well over 200,000 tons this year, which means that the Philippines can no longer boast of being at the top of the list of copra-producing countries, and, with East Africa, the Malay States, and Tropical America forging ahead in this industry, our place is dropping down the list and unless modern methods are adopted here soon this country, which a few years ago was looked up to as one of the two greatest copra countries of the world, will be deplorably outclassed.

A NEW PAPER.

A new nonporous paper is just coming into the market and will probably constitute a great factor in the rapidly growing cinematograph-film trade. This paper, which is known as "Algin," is manufactured from various kinds of seaweed (algae) and is said to be waterproof, fireproof, germproof, and odorless. Its noninflamable quality renders it of the highest value for cinematograph films.

SOYA BEAN.

As was confidently expected, the soya bean has been greatly improved in the past few years, both in America and Europe. Whereas in its home country of Manchuria the oil content is only about 15 or 16 per cent, some of the new varieties which have been bred up in America and Europe run as high as 20 and even 22 per cent. South Africa is now taking up this crop and it is found that altitude somewhat affects the yield of oil in any given variety; for instance, at an altitude of 1,000 meters the yield of a certain variety is about 20 per cent while at seal level it is about 22 per cent. Germany, ranking with France as the heaviest importer of oil seeds, has been trying for years to find a suitable oil crop which could be put under intensive cultivation; this desire seems about to be realized in the shape of soya, many varieties of which can now most likely be grown in Germany with excellent success. In 1912 Germany imported 1,443,447 metric tons of oil seeds valued at 217 million pesos.

GHEE.

Copra oil has a new rival in India. Ghee, or boiled butter, prepared chiefly from milk of carabayas and cows, is used by about one-fourth of the entire population of India, the total consumption being some 3 or 4 kilos per capita per year, or in all about 267,000 tons. The present high price of ghee, however, is forcing the poorer classes to substitute some vegetable oil

therefor in their cooking. The high price of copra practically prohibits the use of coconut oil although this is still used to a great extent in Ceylon. Cottonseed oil is now coming into common use and is, of course, considerably cheaper than even the poorest grades of ghee now on the Indian market.

OLIVE OIL.

The olive-oil output of Greece is estimated at about 19 million kilos for 1913 as compared with 22,500,000 kilos in 1911; this substantial reduction in the output of this oil is one of the contributory factors in the present high price of copra.

TWO NEW OILS.

Two new oils are just coming into commerce from Formosa, chong-guh and yu-chin. These oils are produced by camphor-like trees of the high forest regions of central Taiwan, as we should now call Formosa. The method of producing these new oils is said to be much simpler than that of producing camphor. The chong-guh wood is said to yield as high as 25 per cent of crude oil. The supply of trees is believed to be very large.

CATTLE IN BRAZIL.

Recent estimates of the cattle in Brazil indicate that that country now has something like 30 million head, a little more than Argentina possesses. Brazil has suffered considerably in the last few years from troublesome cattle diseases and insect pests, but the industry is now on a firm basis, and with the new importations of European and American breeding stock and breeding experts, there is no question as to the tremendous success that country will have along this line.

COCONUTS IN PANAMA.

The San Blas coconut of Panama still maintains its reputed superiority over all other varieties of the world. It is not only large but it is a "free sheller," i. e., the meat readily separates from the shell at the time of breaking, thus giving it a great advantage in the hands of confectionery and "shredded" coconut manufacturers in the United States. The raw nuts are shipped in the shell, of course, to the Eastern States for manufacture. The average market price for these nuts is from ₱60 to ₱90 per thousand, but over ₱100 per thousand has recently been obtained in New York for "select San Blas"—the price at Colon remaining fairly steady at about ₱0.06 per nut. As in the Philippine Islands, the common varieties of coconuts in Panama

and Costa Rica are the "green" and "yellow," although a "red" and four or five other sorts are cultivated to a slight extent. Under ordinary conditions, which does not mean modern methods, a tree in Panama is expected to yield 6 to 10 nuts per month.

COCONUTS IN HONDURAS.

Coconut lands in eastern Honduras are rapidly advancing in value and trees are being sold at ₱6 to ₱10 in bearing plantations, the price depending, of course, upon age and condition of the tree, as well as on the location of the plantation.

CACAO IN GUADALUPE.

Cacao planting is now developing rapidly in Guadalupe, French West Indies. This crop is found to give much more remunerative returns than either cane or coffee. A plantation once started in rich soil requires very little expense for upkeep and, providing droughts and diseases do not seriously interfere, the profit to the planter is comparatively very great. There are said to be some 30 varieties, more or less distinct, under cultivation at present in Guadalupe. About 5,000 hectares are now planted and 15,000 laborers are employed. This French colony, therefore, may soon rival Jamaica, Tobago, Dominica, and Trinidad in "raw-chocolate" production.

POULTRY INDUSTRY OF AUSTRALIA.

The poultry industry of Australia has developed a new feature, the exportation of frozen "egg pulp." Hundreds of tons of eggs are broken into cans, sealed up, and shipped across "the line" in freezing chambers. A machine has now been perfected for "pulping" the eggs. Recent low prices (28 to 30 centavos per dozen) for Australian eggs give the middleman and steamship companies a chance to help out the bakers (and themselves, too) who are forced to pay something like ₱1 per dozen in some of the overpopulated districts of the United States.

CACAO IN ECUADOR.

The cacao crop of Ecuador has recently suffered a bad setback and the output for 1913 will probably not be one-tenth of what was predicted at the beginning of the year; the output for 1912 is given as 31,000 tons by one authority and as 35,000 by another. Antiquated methods and the prevalence of more or less unrestricted diseases in the plantations are unquestionably the cause of the decline in the output from this country which a few years ago ranked first on the world's list.

FIG INDUSTRY OF HUELVA.

The Province of Huelva in Spain has developed a very profitable fig industry. In favorable seasons this province now produces some 7,000 tons or more of figs. A good tree in healthy condition yields 75 to 90 kilos of fruit per annum. The wholesale price of the dried figs is about 8 to 10 centavos per kilo.

MEAT AND MEAT PRODUCTS OF ARGENTINA.

As an evidence of the tremendous and rapidly growing importance of meat and meat-products trade of Argentina may be mentioned the following items of export to the United States, which show both the commercial differentiation of some of the new by-products and the relative importance thereof: Dried blood to the value of ₱217,000 was exported in 1911; bones, ₱815,000; fertilizer (largely slaughterhouse refuse) ₱587,000; hides and skins of all kinds to the value of nearly 36 million pesos were exported in 1912. Some of the newer products which are coming into the commercial market are casein (some ₱555,000 in 1911); hair (mostly horse) to the value of ₱760,000 in 1912; casings (for sausages, etc.), ₱775,000 in 1911; horns, about ₱60,000 per annum; lactarina (a new dried milk), about ₱8,500; meat meal, about ₱40,000 per annum; pizzles and sinews, about ₱15,000 per annum; weasands, or windpipes, about ₱19,000 per annum; and glue stock to over ₱100,000 in 1911.

BANANA-FOOD PRODUCTS OF JAMAICA.

The export of banana-food products from Jamaica, British West Indies, is increasing very rapidly. In 1910 the total export of all banana-food products was ₱19,626 while in 1912 it jumped to ₱76,000, about 400 per cent increase. Germany continues to be the principal importer of these rich but cheap new foods, with the United Kingdom a close second, while the United States evidences but little interest in the matter. Vacuum driers are now coming into use, which will mean a considerable improvement in the color of the finished product. The United States Pure Food and Drugs Act necessitates labeling "banana figs" at the ports of entry as evaporated or dried bananas.

LOCUSTS IN VENEZUELA.

Venezuela has been suffering very severely from a plague of locusts, the crops in some districts having been entirely consumed.

SODA FROM BRITISH EAST AFRICA.

A new enterprise in British East Africa is developing which may reduce the price of copra in the near future. Immense deposits of soda have been discovered at Lake Magadi, and a branch of the Uganda railway has been constructed to the soda lake which has an area of some 7,500 hectares. A few hundred thousand tons of this crude soda will, of course, reduce the cost of soap and probably permit of a wider range of materials for soap making, and this will tend to slightly reduce the price of low-grade copra, although the better grades used for coconut-food products will not be seriously affected.

WHALING IN PORTUGUESE EAST AFRICA.

Mozambique, or Portuguese East Africa, now has five whaling stations in operation. Up to 1910 this exceedingly profitable industry was not in evidence in that country, although at Durban, Natal, some 200 miles to the south, a very prosperous whalery had been operating for two years. These five stations, the site of one of which was selected by the writer in 1910, are reported to have caught almost at once some 1,200 whales, mostly of the humpback (*Megaptera longimana*) species, although both the blue and the fin are sometimes taken. The blue, which attains a length of 30 or more meters, gives the greatest quantity of oil and is worth on the slaughter boards something like ₱1,000, while the fin, which reaches a length of some 20 to 25 meters, is nearly as valuable; the humpback of 10 or 12 meters, when made into oil, meat meal, bone meal, etc., is worth about ₱500. The tremendous quantity of whale oil now being put upon the market from the Antartic, South Indian, south-eastern Pacific, and Arctic regions would decidedly reduce the price of copra did not the demand for coconut-food products keep increasing by leaps and bounds. The revival of the old whaling industry, however, is due to receive a setback soon by reason of the fact that the wholesale slaughter of these huge mammals must needs be stopped for at least a few years in order to give the whales time to multiply and fill up their decimated ranks, as it were. In this connection it should be remembered that the ordinary whale probably does not reach maturity under 15 or 20 years.

CATTLE IN PARAGUAY.

About 3 million head of cattle are believed to be in evidence in Paraguay. There are two saladeros, or meat-extract and salt dried meat factories, requiring between 40,000 and 50,000

head per annum. The slaughterhouse at the capital, Asunción, calls for about 35,000 head per year. However, since the population of the entire country does not exceed 800,000 inhabitants, Paraguay must be considered one of the greatest if not the greatest cattle country of its size in the world.

COPRA IN ZANZIBAR.

Zanzibar exports about 12,000 tons of copra per annum. This port, the center of the clove trade, also exports 1,000 tons of cloves; the export of the latter crop for 1912 was worth less than half as much in that year as in 1911 (₱384,000 against over ₱800,000).

COTTON IN INDIA.

We little realize the extent of the cotton industry of India, but when we consider that the 1912–13 crop was estimated to give about 1,800,000 tons of seed as a *by-product,* we can partially appreciate the tremendous importance of that crop.

CACAO IN GOLD COAST.

Cacao production in Gold Coast is rapidly increasing. For the first six months of 1912 the exports were some 19,000 tons while in the same period for 1913 over 23,000 tons were shipped. The output of this one colony will probably soon be over 75,000 tons per year. The plantations moreover are all comparatively young, i. e., under 12 years of age; this is a striking example of what modern methods will accomplish with an old crop in a new country.

PHOSPHATE FROM THE PRATAS ISLANDS.

A new source of phosphate has been located on the Pratas Islands between Hongkong and Manila. It is expected these beds will give an output of some 25,000 tons for at least several decades.

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

(Temperature and total rainfall for 24 hours beginning at 6 a. m. each day).

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		San Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	26		26.4		26.9		24.4	3.6	25.3		28.7	
2	27.7	0.3	27	0.5	27.3		26.8		25.2		28	
3	27.5	16.6	27.2	2.8	27.2		27.2		26.1		27.3	
4	26.3	5.6	26.4	2.5	27.3	43.7	24.9		25.8	2.5	28.2	
5	25.6	24.4	26	5.4	26.8	18.8	26.4	5.8	25.9	2.3	28.2	0.8
6	27.6	2.5	26.5	7.4	27.2		26.4		26.1		27.7	
7	28	5.8	26	2.5	27		27.4		26.2	.5	27.6	
8	27.1	25.1	26.7	5.9	27.2		27.6		26.6		27.6	
9	27.5	.3	27.1	13.5	27.1	9.1	27.6		25.7	1	27.1	
10	27.7	1	26.2	3.3	27.1		28.2		26.6		28	
11	26.4	5.9	26.6	11	26.6		28		25		27.4	
12	27.6		27.2		27		26.4		24.9		27	
13	26.5	.3	26.1		25.6		26.8		25.2	1	27.4	
14	25.8	4.3	24.6	3.8	25.4		28.4		24.4	8.6	27.2	
15	25.7	.3	24.3	11.9	24.3	11.2	25.8		24.1	8.4	25.4	
16	26.8		24.4	1.8	25.9		26.2		23.9	1	25.6	
17	26.7		25.2	17.5	26.2		26.3		23.7		26.2	
18	26	2	25	2.5	26		26		24	11	27.4	
19	26.8	15.9	25.4	18.5	27.2		27		25.4	1.9	26.6	
20	27.4	4.6	25	36.5	26.8	11.1	27.8		25.5	1.5	26.8	
21	26.4	13	26.6		26.1		27.4		24.2	10.2	27.2	
22	26.4	19.9	27.2	.8	26.4		27.2		24.8	.3	26.2	
23	24.5	66	26.5	1.8	26.6		27		25.1		26.8	
24	25.8		25.8	9.7	25.6	4.8	27		24.6	4.3	26.8	
25	25.3	2.5	26.2	.8	25.6		26.8		23.2	5.1	25	
26	26.1	16.3	25.5	59.2	26		26.7		24.2	14.7	25.2	
27	25.1	37.5	26.3	.8	26.2		26.1		24.4	16.8	26.8	
28	26.4	2.8	26.7		26.9		27		24.1	3.3	27.8	
29	26.6	10.4	27.1		27		27.1		24.6		26.8	
30	25.4	35.8	26.3	27.2	26.3	7.1	27.8		25	.5	26.4	

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[1] On leave.

(*a*) Biriba, shieldbudded on mamon, Lamao Experiment Station, 1913.

(*b*) Custardapple, shieldbudded on soursop, Lamao Experiment Station, 1913.

(*c*) Soursop, shieldbudded on custardapple at Lamao Experiment Station, 1913.

THE PHILIPPINE

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REVIEW OF THE WORK OF THE BUREAU OF AGRICULTURE COVERING THE PERIOD FROM OCTOBER 15, 1911, TO FEBRUARY 15, 1914.

By F. W. TAYLOR, *formerly Director of the Bureau.*

A backward glance at some of the things which the Bureau of Agriculture has done or attempted to do within recent months may not be inappropriate at the present time when the writer has presented his resignation as Director of Agriculture and is about to leave the Archipelago.

His actual connection with the management of the Bureau commenced on October 15, 1911, and the period elapsing between that date and the date of his resignation, February 15, 1914, is two years and four months.

In October, 1911, the great question in the minds of the officials of the Bureau of Agriculture was the rinderpest problem. At that time there was disease in nearly half the provinces of the Archipelago, in many of which the number of deaths was so considerable as to cause much alarm. From that date until the present more than half of all the funds of the Bureau, averaging over half a million pesos per year, have been spent in the rinderpest fight. Since that time twenty-nine provinces in the Archipelago have had the disease at one time or another. It has been successfully wiped out until at the present time there are but five provinces affected, in which five provinces there are thirteen municipalities where the disease still lingers. In only one province, Pampanga, has the disease been persistent during the entire period, and at the present moment more than half of all of the disease in the Philippines is in that one province.

The lowest point of the disease was reported January 20, 1914, when there were but four provinces infected. The report for February 2 shows the following provinces and number of municipalities infested:

Laguna, disease in one municipality.
La Union, disease in one municipality.
Mountain, disease in one municipality.
Pangasinan, disease in three municipalities.
Pampanga, disease in seven municipalities.

The number of deaths occurring now averages less than two per day. This makes the loss so slight as to be scarcely worth considering so far as the financial side of it is concerned. Every effort, however, is being made to continue the work of reducing the disease to the vanishing point. Whether or when this can be done no one is properly competent to judge, but the fact remains that the great losses from the disease have been practically stopped and the number of new cases is growing continually less.

The rate at which the number of cattle and carabaos in the Islands is increasing is most satisfactory, as indicated by the following figures. From the quarterly reports of the Bureau, which are reasonably accurate, although considerably below the actual numbers, the following data are given:

On June 30, 1911, there were in the Philippine Islands 1,098,938 head of cattle and carabaos. On December 31, 1913, the total number was 1,498,508, an increase in two years and three months of nearly 50 per cent. Actual counts made in various widely separated municipalities have always shown an average of 20 per cent more cattle and carabaos than have been reported in the official papers. That would mean that at the present time there are at least one million, eight hundred thousand head of cattle and carabaos. At the rate of increase which has been going on for the last two or three years it is certain that the needs of the Islands will soon be entirely supplied for work cattle, and nearly or quite supplied for meat, thus doing away entirely with the necessity of any further importations. This desirable result can only be reached by maintaining at its past rate of efficiency the fight against rinderpest so that it shall not be given an opportunity to break out and again devastate the Islands.

There had been no definite assignment of the funds of the Bureau to the various lines of activity being carried on. This made it very hard for the Director to know what was doing, and also made it impossible for any division chief to rest assured that when he started a piece of work he would have funds to finish it.

All the activities of the Bureau are now carried on under seventy-six different projects. Each one of these is gone into carefully at the beginning of the fiscal year and the Director formally sets aside an amount of money for each, within which amount the division chief is expected to keep his expenditures. This has been productive of greatly increased efficiency and it

is believed that a given amount of money secures much better returns than when indiscriminate expenditures are made.

There was inaugurated almost immediately a system of cooperative demonstration in connection with various provinces. At the present time coöperative work is being carried on in seven provinces, and it is intended to increase this number as funds are available, and as provinces indicate their desire and ability to do their part in the work.

This work is intended to bring the Bureau in the closest possible touch with the man who is actually farming. The results obtained have been very satisfactory and it seems certain that the greatest good to be done by the Bureau of Agriculture will be along this line.

There are in the Philippine Islands nearly or quite one thousand different varieties of rice. Some of these are doubtless going to prove nearly duplicates, but the real number of varieties is very great. Work has been carried on looking toward finding out the best dozen or so varieties from this great number and progress enough has been made so it is certain that if the work is continued it will be possible within one or two years more to send out these chosen varieties and thus make possible an increase of from 10 to 20 per cent in the rice crop of the Islands.

Similar work is being carried on with reference to the various other farm crops. In the case of the various citrus fruits there has never been any propagation in the Philippines except by seed. This is so crude and unreliable a method that the Bureau has made arrangements by which the process of budding and grafting can be demonstrated at the various demonstration stations and elsewhere. The results from these demonstrations have been excellent and when it is clearly understood that this sort of work is not experimental, but purely practical and following out the best methods of all the fruit regions of the world, the methods will no doubt be followed by all intelligent planters.

The greatest export of any one crop in every normal year is that of fibers. The quality of much of the fiber going out now is very low and the business is likely to be seriously injured unless laws are passed to encourage the production of the better grades. The Bureau has been working very hard along that line and a law has been prepared which is to be presented to the present Legislature, and which, if passed, will doubtless do much to better the conditions.

The AGRICULTURAL REVIEW was formerly made up very

largely of material gathered from various other similar publications. For nearly the entire period since October, 1911, every article published in the REVIEW has been written by members of the Bureau of Agriculture. A few foreign notes are run but the main body of the magazine is entirely original. Special numbers have been introduced, devoted to specific subjects.

Only a few of the more striking things which have been accomplished or put under way within the last two years have been touched upon in this article. That such is the case is due entirely to lack of space, since there are many other things which it would be very interesting to mention.

The present writer when asked upon arrival in the Philippines as to the policies which he proposed to put into effect replied: "I have but one policy and that is to build up the agriculture of the Philippine Islands." In leaving the work he desires to express appreciation of the many courtesies which have been extended to him and particularly for the helpful way in which many people in the Islands have joined directly or indirectly in the demonstration and other work of the Bureau. The organization and executive work of the Bureau have taken practically all of the Director's time and his only hope upon leaving the Islands is that such part of that organization and preparation for effective work as is worthy, may be maintained and that the results in future years may be great. Not much can be done in the building up of any country in two or three years. There is no patent or easy road to success in agriculture. It should be taught everywhere that the work of the agriculturist is as dignified, as honorable, and as helpful to a community as that of any other profession. In fact, in a country like the Philippines it is by far the most important profession and consequently should receive the energies and mental activities of the citizenship. When practically every head of a family in the Philippine Islands owns his own home or the land which he tills, then there will be no danger from political upheavals and the people will stand together as a unit in a way that can be brought about by no other conditions.

BUREAU OF AGRICULTURE CIRCULAR No. 28—PROPAGATION OF THE SEEDLESS BREADFRUIT.

[CIRCULAR No. 28. Manila, P. I., December 10, 1913.]

PROPAGATION OF THE SEEDLESS BREADFRUIT.

By P. J. WESTER, *Horticulturist in Charge of Lamao Experiment Station.*

The seedless breadfruit (Plate II) is one of the most nutritious, wholesome and well-flavored fruits in the Philippines when properly prepared. Regretably enough, it is also one of the rarest fruits in the Archipelago when it should be one of the staple fruits in every market; as a matter of fact the seedless breadfruit is so seldom offered for sale that it cannot be said to be a market commodity.

The principal reason for the scarcity of breadfruits is that the tree, being seedless, unlike most other fruit trees cannot be propagated from seed. In some parts of the Philippines at least it is known that the tree may be propagated by marcottage, but this method is rarely used. Many owners of old trees have noted, of course, that a root will sometimes send forth a growth that will develop to a tree if it, together with a part of the old root, is severed from the parent tree and planted, but it appears that very few, if any, planters have taken advantage of this fact and propagated the tree on a large scale by the root-cutting method.

The ability of the roots of the breadfruit to sprout under certain conditions led to a series of experiments, in 1913, at the Lamao experiment station, with the object of finding, if possible, a simple and practical method whereby this tree might be propagated cheaply on a large scale. Several other modes of propagation tried out in the experiments failed; but with the method hereinafter described over 75 per cent of the cuttings developed into healthy plants.

The propagating bed should be located in a sheltered and shaded situation, for instance, under a large spreading tree. It should also be well drained, so that no stagnant water collects around the cuttings.

In the place where it is desired to locate the propagating bed, dig out the soil to a depth of about 18 centimeters; fill in with

clean, not too fine, fresh-water sand, or in default of this, salt-water sand (provided that all the salt is washed out before placing in the propagating bed). If good sand is not obtainable, sandy loam may be used, though this has been found less satisfactory than sand.

The soil should now be carefully removed to expose the roots of the tree from which it is desired to take the cuttings, due care being taken not to bruise or injure the roots or to leave them exposed too long in the sun. Larger cuttings may be used, but for the sake of convenience in handling, and in order not to severely tax the vitality of the parent tree, it is perhaps better not to cut roots that are more than 6 centimeters in diameter. Even the small roots 1.5 centimeters in diameter may be made into cuttings, in fact, cuttings have been rooted that were only 1 centimeter in diameter. At Lamao the cuttings have been made 25 centimeters long, but it is quite possible that cuttings 20 centimeters long will do equally well. If the roots are sawed

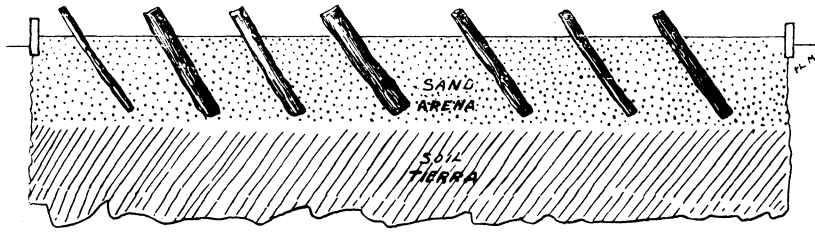


Fig. 1. Sectional view of propagating bed showing method of inserting root cuttings of the seedless breadfruit.

off in the proper lengths, the cut surfaces should be smoothed with a sharp knife before the cuttings are inserted in the propagating bed.

In placing the cuttings in the propagating bed dig a hole with a trowel, and set the cutting diagonally in the soil, as indicated in the accompanying figure (fig. 1), not straight up and down. About 4 to 6 centimeters of the cutting should stick out of the ground. Do not attempt to push the cutting down into the soil because it would injure the end and so delay callousing and invite decay. Be sure that the cutting is so inserted that the end with the greatest diameter points upward. It is also very important that the sand or soil be packed firmly around the cuttings. The rows should be 30 to 50 centimeters apart and the cuttings about 20 to 30 centimeters in the row. The bed should be watered thoroughly, but not too often. If the cuttings are made during the rainy season (which is, perhaps, more favorable for their rooting than the dry season), the bed requires no

further attention until the cuttings have rooted and are ready to be planted in the nursery; care must be taken, however, that water does not accumulate around the cuttings (which in such a case are more likely to rot than to root). During the dry season the bed must be well watered whenever the surface shows signs of being dry.

The sprouting of breadfruit root cuttings is very irregular. Some cuttings may rot and be ready for the nursery within two months from the date of their insertion in the bed, while others will barely sprout in five months. Be this as it may, when the sprouts have attained the height of 20 to 25 centimeters, and the growth is well ripened, the cuttings should be carefully removed from the sandbed and planted in rich, friable, loamy soil, in a shady, wind-protected place.

When the plants are 60 centimeters tall they are ready for transplantation to the fruit orchard. Then trim off all tender growth and three-fourths of the foliage, take up the plant with a large ball of earth so as to disturb the roots as little as possible, and carry the plant to its permanent place. Dig a hole from 75 centimeters to 1 meter in diameter and about 40 centimeters deep. In setting the plant fill the hole with surface soil instead of the subsoil dug out of the hole. *Do not set the plant deeper in the orchard than it grew in the nursery.*

Whenever a plant is transplanted, always water it thoroughly before it is taken out of the soil and after it is planted; never permit the roots to dry out from exposure to the sun or the air.

Breadfruit trees should be planted 9 to 10.5 meters apart.

SIMULTANEOUS METHOD OF INOCULATING CATTLE AND CARABAOS WITH SERUM FROM ANIMALS THAT HAVE BEEN RECENTLY IMMUNIZED.

By ARCHIBALD R. WARD, *Chief Veterinarian,*
AND
FREDERICK WILLAN WOOD, *Supervising Veterinarian.*

The earlier literature concerning antirinderpest serum contains frequent references to the idea of increasing the protective power of the serum by successive injections of virulent blood into the animal producing the serum. The idea is emphasized that the serum of such hyperimmunized animals is preferable to the serum from animals that have merely been immunized naturally or artificially.

Braddon(1) states that in South Africa the method of injecting uninfected animals with defibrinated blood of animals which had recently recovered from pest, as a preventive method, was abandoned in favor of Turner's method of using serum from animals that had received successive and increasing doses of virus.

Turner(2) states that in the Transvaal and Natal, an immune animal was injected with 100 cubic centimeters of virulent blood, and after all reaction had ceased it was bled. This blood, when defibrinated, was injected into a susceptible animal which was smeared on the muzzle with virulent material and placed with animals suffering with rinderpest. This method of simultaneous inoculation, using blood prepared at the time, seems to have been abandoned in favor of one employing a serum requiring more elaborate preparation.

Since the use of serum from hyperimmunized animals came into general use in simultaneous inoculation, Gibson(3) is the first writer known to us, who has questioned the necessity of hyperimmunizing serum-producing animals.

Shealy(4) makes a similar observation to the effect that the results obtained with the serum prepared from animals after recovery from an attack were found to be just as good as when the animal was not bled until it had been hyperimmunized.

Subsequent to the completion of the field work described

herein, there has come to notice the work of Holmes(5) which gives additional information regarding the overestimation of value of serum from hyperimmunized animals. He concludes that the serum obtained after natural recovery or after an immunizing reaction is little inferior in potency to that taken after the process of hyperimmunization.

Holmes further points out that satisfactory virulent blood may be obtained from an animal suffering a modified attack due to the injection of serum. Thus, the animals producing virulent blood recover, instead of being sacrificed as formerly.

The work of the present writers was undertaken with a view of reducing the cost of serum to a point that would warrant more extensive use of simultaneous inoculation. The serum formerly produced by the Bureau of Agriculture cost, delivered in the field, 24 pesos per liter. That this is not excessive is shown by the fact that in the Transvaal the cost was 25 pesos per liter. Small quantities purchased by the Bureau of Agriculture from the Pasteur Institute at Nha-Trang, French Indo-China and from the Experiment Station for Animal Diseases, Tokyo, Japan, were charged for at the rate of 47.89 pesos and 34.40 pesos per liter, respectively. With serum costing 24 pesos per liter and with the doses employed by the writers, the expense in simultaneous inoculation for the one item of serum would slightly exceed 8 pesos per animal.

In deciding to try the use of serum from animals that had just been immunized instead of employing expensive serum from the so-called hyperimmunized animals, the writers were guided by several considerations. One, when superintendent of the serum laboratory of the Bureau of Agriculture, carrying on the routine work there of immunizing susceptible animals for serum production, employed serum in several cases from animals that had recently reacted. The results were as satisfactory as if hyperimmune serum had been employed. Further, previous experience(6) had shown that the severity of the immunizing reaction could be controlled by the amount of serum employed. Thus, if the serum drawn in the field proved to be appreciably low in protective power, the fault could readily be corrected.

The work was inaugurated in Ilocos Norte Province on carabaos belonging to the Calamba Sugar Estate, and intended for shipment to their estate at Calamba, Laguna. When the immunization was begun, there was available a supply of serum from hyperimmunized animals only sufficient for the first three lots of carabaos as indicated in Table I. All animals immunized subsequently to these received serum drawn in the field.

The animals while undergoing immunization were confined in large sheds erected by the owners of the carabaos, who likewise fed and cared for the animals during the twenty-five days required for immunizing.

Each animal to be immunized, while being injected, was confined in stocks made of bamboo. It received a hypodermic injection of the dose of antirinderpest serum which had been decided upon as sufficient. This standard dose was administered uniformly without reference to the size of the animals.

In the case of the carabaos belonging to lots 1, 2, 3, and 4 shown in Table I on page 104 it will be noted that gradually increasing doses were employed until there were obtained results thoroughly satisfactory as regards death rate and severity of reaction. In determining the dose, it was considered advisable to use an amount of serum necessary for the most susceptible animal likely to be encountered, for there exist no means for predicting susceptibility. After the immunization work was under way, the virulent blood was invariably obtained from an animal undergoing immunization at a stage corresponding to the third day of febrile temperature. Thus, there was no expense for susceptible cattle for maintaining a strain of virulent blood and no trouble of finding natural cases of rinderpest in the vicinity was necessitated.

In all cases, before virulent blood was employed, it was examined microscopically for the presence of the trypanosomes of surra in fresh and stained preparations.

One hundred and ninety-six of the 429 animals in Table I, which showed no febrile reaction, were reinjected with 10 cubic centimeters of citrated virulent blood. This was done in case that the original virulent blood had been inactive when employed or some accident had prevented its introduction. Up to date, only three distinct reactions from such injection have been observed.

In the preparation of serum in the field, between 2 and 3 liters of blood were drawn from the jugular vein of all recovered animals without reference to whether or not they had reacted to the virulent blood. In a previous(6) paper it has been shown that serum from reactors is somewhat more potent, but with the dose employed, this feature was not of sufficient value to warrant exempting nonreactors from the bleeding.

No blood was drawn from very old or very young, nor from pregnant animals. These exceptions reduced the number bled

to 72 per cent of the animals immunized. An average of 2.8 liters of blood per animal was drawn from 305 animals.

The technique employed in drawing blood for serum production varied in no essential particular from general practice. An autoclave heated by a gasoline torch was employed for sterilizing the instruments and bleeding flasks. No abscess formation has followed the bleeding. Large hæmatomas form occasionally, but are soon resorbed.

Blood was allowed to stand in the bleeding flasks immersed in running water in the bed of a shallow stream for from twenty-four to thirty-six hours, after which the serum was decanted into a large graduated vessel and 0.5 per cent of carbolic acid or formalin was added as preservative. The serum was then stored in 15-liter demijohns tightly corked. Serum prepared in this way has kept well for several weeks. The only trouble encountered was due to the fact that serum sometimes assumed a gelatinous form upon standing.

The serum thus prepared was ready for use, there being omitted the expensive operations of centrifugalization, filtration, and rebottling. There is nothing connected with the preparation of serum under field conditions which requires an expensive permanent plant. Experience has shown that the essential asepsis can be readily attained in a temporary structure made of grass and bamboo.

It should be noted that no ice was available for refrigeration. The necessity of holding serum for a long period was obviated by preparing it with reference to the time that it would be needed.

The results obtained during the immunization of the carabaos at Laoag are shown in Table I. In compiling the data regarding reactions, there has been adopted as a standard of minimum rise of temperature to be counted as a reaction, a rise to 39° C. on two successive days, occuring between three and twelve days after inoculation. This standard is wholly arbitrary and somewhat unsatisfactory when applied to cases closely approaching it; however, none more generally useful is known. In the case of the animals in question, the dose employed was such and the average resistance of the animals of such a degree that elevation of temperature does not figure prominently. Other symptoms of rinderpest such as diarrhœa and inflamation of the conjunctivæ occured, but this occurence was not uniformly recorded on the temperature charts.

TABLE I.—*Record of immunization at Laoag of carabaos belonging to the Calamba Sugar Estate.*

Lot No.	Number injected.	Date of injection.	Serum per head.	Febrile reactions.		Number released.	Loss after injection.	
				No.	Per cent.		No.	Per cent.
			c. c.					
1	8	July 28	200	4	50	6	2	25
2	70	Aug. 11	300	28	40	70	0	0
3	63	Aug. 23	300	48	76	60	3	4.7
4	65	Aug. 28	350	43	66	65	0	0
5	27	Sept. 8	350	15	56	27	0	0
6	15	Sept. 12	350	13	86	15	0	0
7	10	Sept. 15	350	2	20	10	0	0
8	26	Sept. 24	350	4	15	26	0	0
9	31	Sept. 26	350	6	19	31	0	0
10	51	Oct. 3	350	22	43	51	0	0
11	63	Oct. 9	350	42	66	62	1	1.5
Total	429			227	52.9	423	6	1.4

It will be observed that all of the deaths, except one, occurred in the first three lots. In the case of those animals only, serum made in the laboratory from hyperimmunized animals was used. Increase of the dose of serum from 200 cubic centimeters to 300 cubic centimeters practically stopped losses.

It is believed on the basis of the previous work(6) and that of Holmes(5) that an animal may be immunized by simultaneous inoculation without showing either fever or symptoms. Therefore, it is thought it possible that more susceptible animals may have been immunized than shown in the table.

Table II gives data concerning the number of animals in each lot which attained maximum temperatures of a degree corresponding to four classes chosen arbitrarily.

TABLE II.—*Febrile reactions among carabaos at Laoag.*

Maximum.	Lot No.—											Totals for each temperature class.	
	1	2	3	4	5	6	7	8	9	10	11		
												Number.	*Per cent.*
40° or over	4	15	45	33	11	10	1	2	2	15	20	158	[a]69.6
39.5° to 39.9°	0	12	1	8	3	2	1	1	2	6	14	50	[a]22
39° to 39.4°	0	1	2	2	1	1	0	1	2	1	8	19	[a]8.3
Under 39°	4	42	15	22	12	2	8	22	25	29	21	202	[b]47.1
Nonreactors													
Total number of animals	8	70	63	65	27	15	10	26	31	51	63	429	

[a] Per cent relation to 227, the total number of reactors.
[b] Per cent relation to 429, the total number injected.

It will be noted that 46.3 per cent of all failed to reach 39° C. and are not reckoned as having shown a febrile reaction in accordance with the standard described above. Comparatively few attained a temperature between 39° and 39.5°.

In considering the results of immunization, there arises a

question regarding the general susceptibility to rinderpest of the animals in the district where the work was carried on. Inasmuch as a very strict system of quarantine and inspection of animals was in force in the same province at practically the same time, some data can be presented. During the period from September 20 to December 27, 1913, in the same province and in almost adjoining municipalities, 94 cases of rinderpest were discovered of which 36 died, a number corresponding to 38.3 per cent. This in our experience is a moderately low death rate; we have observed it to vary from 33 per cent to 100 per cent elsewhere. A low death rate is generally considered to indicate a high resistance of the animals to the disease or a low virulence of the strain of virus harbored by the animals in the community. Therefore, with regard to the death rate prevailing naturally at the time, the work of immunization was conducted under favorable circumstances.

Subsequent to the work of immunization at Laoag, extensive work of the same kind for the general public has been carried on at Dingras and at Solsona by Dr. J. R. Burns.

From October 11, 1913, to January 25, 1914, 1,657 animals were immunized in these municipalities, not counting 954 animals injected previous to this date but not completed. More would have been injected during the period but for the fact that 65 liters of serum have been shipped to Manila for use in starting the work elsewhere. The total number of deaths during immunization for the period was 23, which corresponds to 1.3 per cent of the number injected.

As the work has progressed, the expense has been materially lessened. The immunization of 429 animals at Laoag cost the Bureau 3,994.11 pesos, about 9 pesos per animal. The work was essentially experimental in character and was conducted slowly and cautiously.

Conditions of routine field work are more closely represented by the work in Dingras and Solsona. For the period October 11 to December 31, 1913, the following expenditures were made by the Bureau:

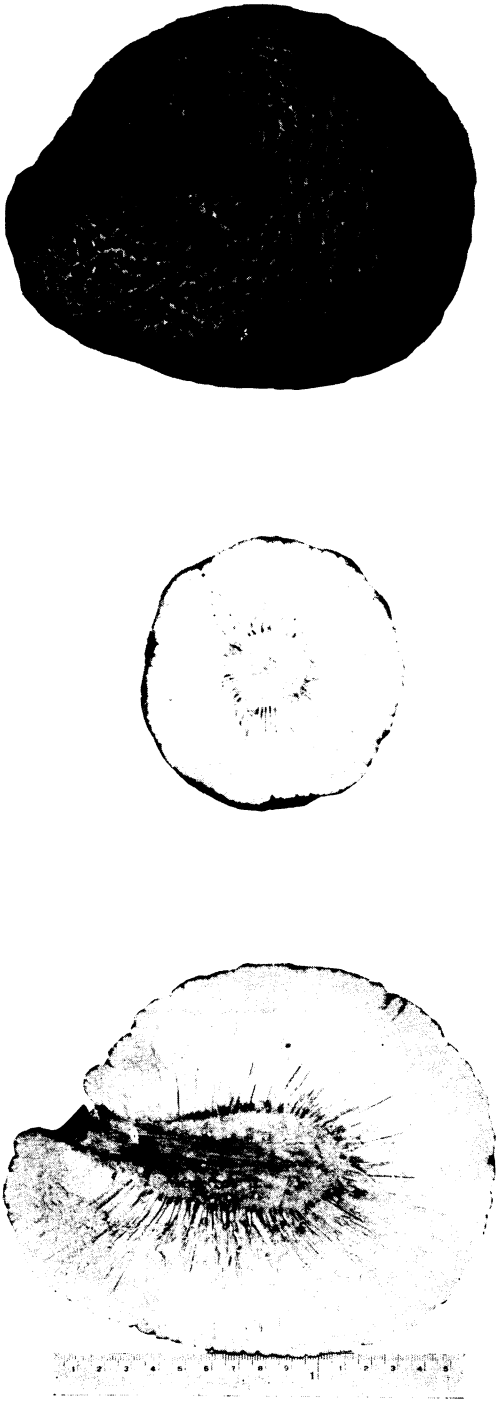
October.	
Salary of 1 veterinarian, 5 days, at 333.33 pesos per month	₱55.55
November and December.	
Salary of 1 veterinarian, at 333.33 pesos per month	666.67
Wages of 10 laborers, at 20 pesos per month	400.00
Wages of 2 laborers, at 45 pesos per month	180.00
Expendable supplies furnished during period	123.55
Total	1,425.77

No item is included to cover cost of autoclave, bleeding-table, and like apparatus which are permanent in character. Autoclaves complete with gasoline heating apparatus are obtainable for 300 pesos and bleeding-tables cost 93 pesos each. At all times during the work, several veterinarians and inspectors have participated in the work to receive instruction in technique, but as their presence was unnecessary for doing that work their salaries and traveling expenses have not been included in the statement of expenses. Only five days of the time of one veterinarian during October is charged for, as he was employed on the work in Laoag for the remainder of October.

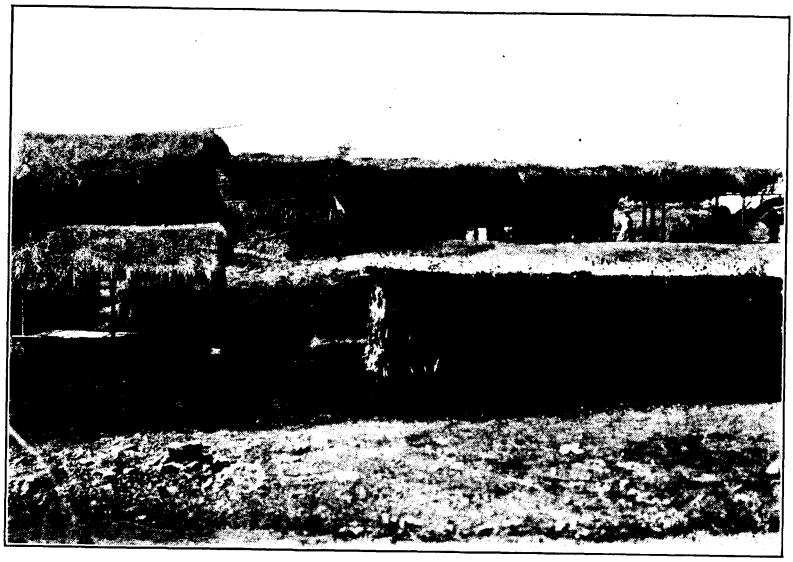
Estimates of the number of animals immunized per month and the cost based upon the early period of the work do not constitute an index of progress under conditions when it is thoroughly under way. A scarcity of serum during the early stages limits the economical employment of labor. Thus from October 11, 1913, to January 25, 1914, an average of 473 animals per month were immunized at a cost of approximately 1.50 pesos per head. During the four weeks beginning December 28, 790 animals were released. However, during this same month, 1,056 were injected, which will be approximately the number of immunized animals that will be released a month hence. Estimating the expenses for salaries, labor, and supplies at 685 pesos per month, which is the average for November and December, it is concluded that the immunization of the 1,056 animals injected during the month beginning December 28 cost the Bureau 65 centavos apiece. It is believed that this rate of progress can be improved by instituting certain changes affecting the amount of travel.

Had the serum employed in Dingras and Solsona been produced in a serum laboratory, there would have been an added expense up to January 25 of 21,932 pesos, reckoning the cost at 24 pesos per liter. This would have brought the expense up to 8.40 pesos per animal, a cost deemed prohibitive.

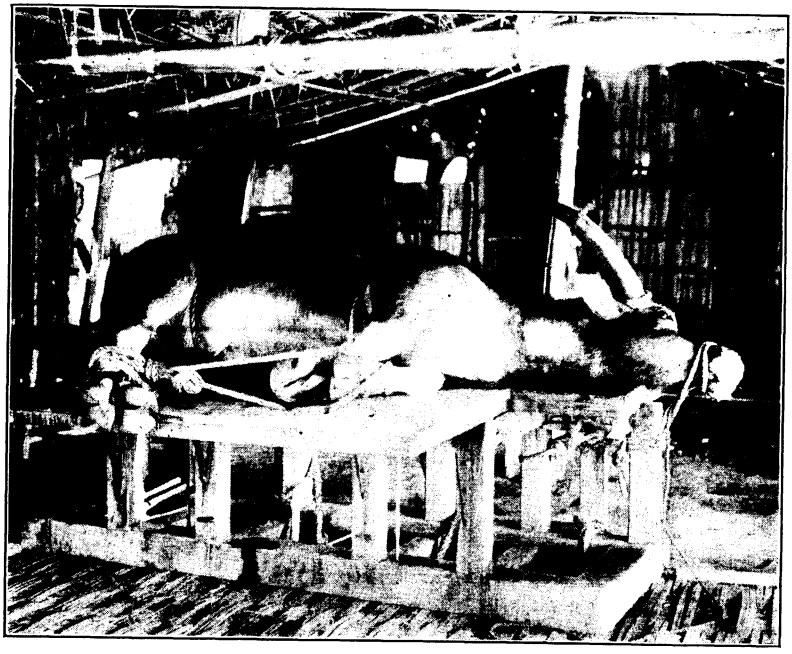
At the inauguration of the work, the owners of the animals to be immunized constructed the group of laboratory sheds shown in Plate III, *a*. The bleeding is done in the partially enclosed shed in the right background. Plate III, *b* shows a carabao in this shed, restrained for bleeding. The first stage of placing an animal on the table is shown in Plate IV, *a*, and the method of bleeding in Plate IV, *b*. Both of the last two operations were photographed in the open air in order to obtain better light. The veterinarian holding the needle and one assist-



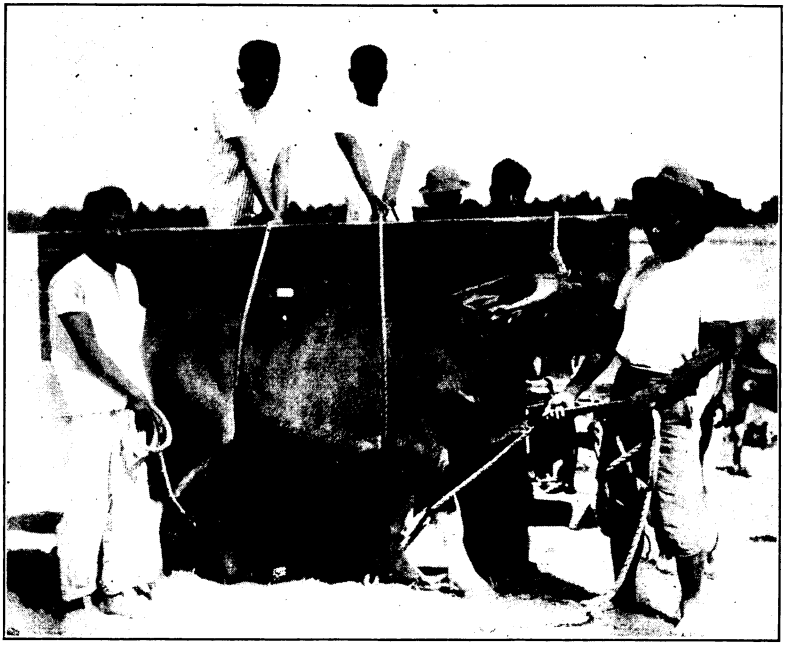
Common type of seedless breadfruit (*Artocarpus communis* L.).



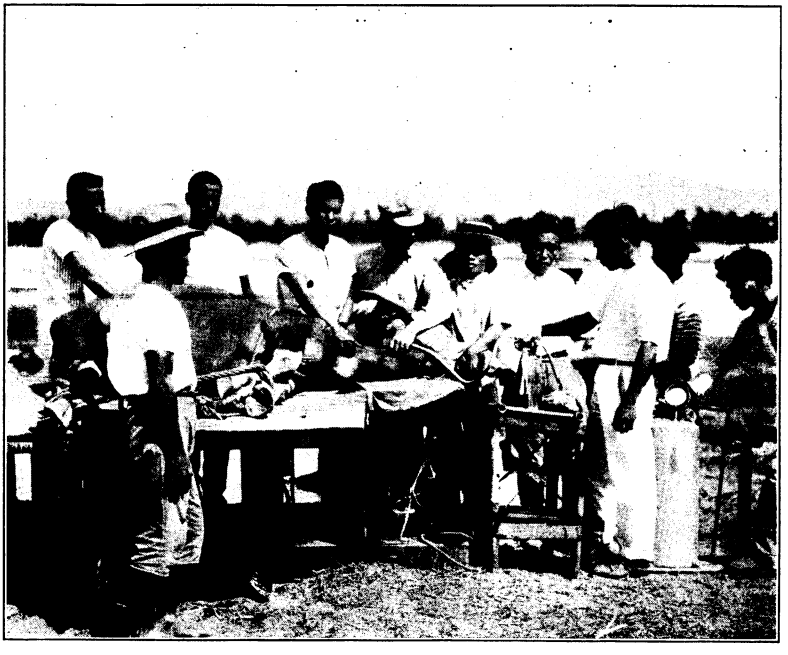
(*a*) Field laboratory for the production of antirinderpest serum, Dingras, Ilocos Norte.



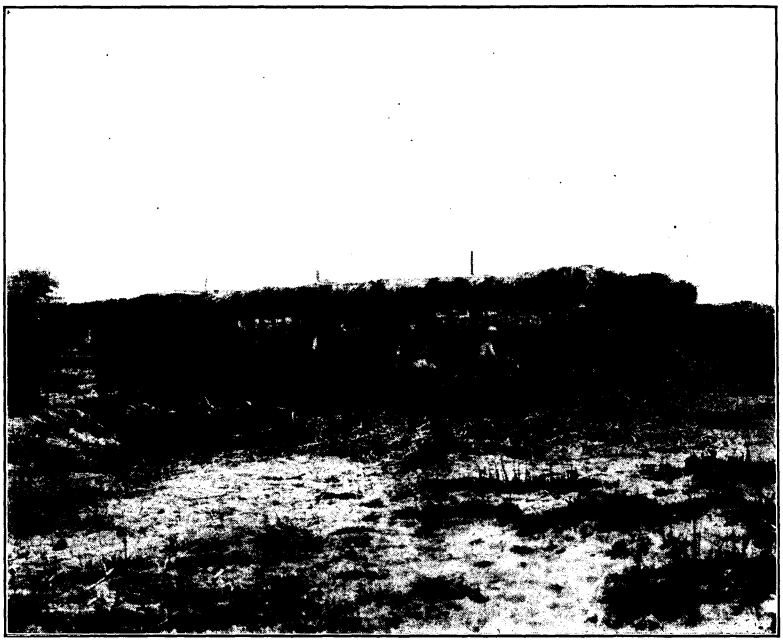
(*b*) Method of restraining animal for bleeding.



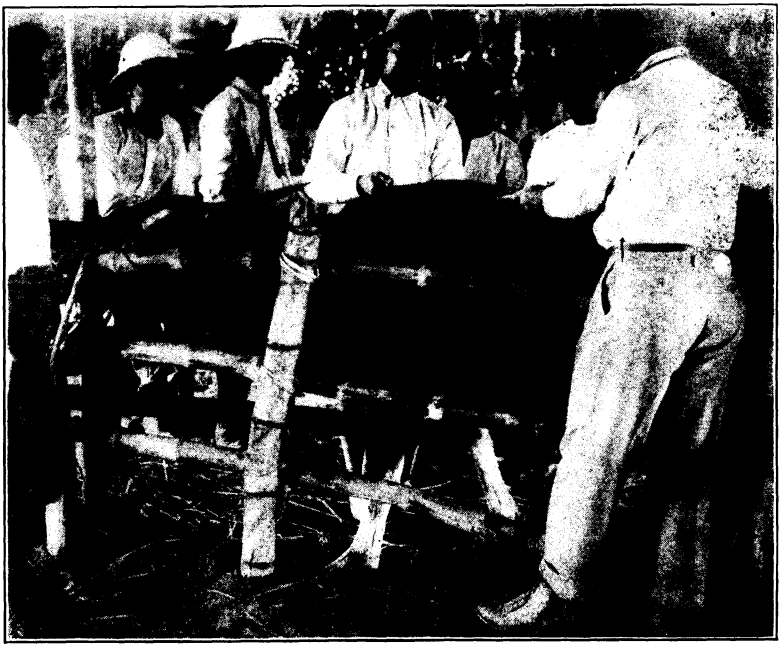
(*a*) Method of restraining animal on bleeding-table.



(*b*) Operator drawing blood for the production of serum.



(*a*) Shed in which animals are injected with virulent blood and serum.



(*b*) Operator injecting carabao with virulent blood and serum.

ant customarily stand on the opposite side of the animal. Other parts of the group of buildings in Plate III, *a* house the office and general workroom. The bottles of blood after drawing and while the serum is exuding from the clot are placed in the stream bed in the enclosed building in the foreground. Adjoining these sheds are others for accommodating animals during immunization, the construction being of the cheapest character and primarily designed to merely afford complete shade. Another shed in the group shown in Plate V, *a* contains stocks for restraining the animals during injection. The process of injection in this shed is shown in Plate V, *b*.

Serum is all prepared at the central laboratory and all immunized animals are brought there for bleeding. Immunization is carried on in other localities, some of them 10 kilometers distant, serum from the laboratory being sent out in demijohns. In every case, the owners of the animals have cheerfully constructed the necessary sheds. When these are needed, each man brings with his carabao one or two bamboo poles and a bundle of grass, and assists in the construction.

Each animal immunized is branded on the right shoulder with numbers designating the province and municipality. All animals immunized in Ilocos Norte bear the number 1 and to the side of this is placed a number referring to the municipality. Thus the brand 11 indicates Laoag; 12, Dingras; and 13, Solsona; all in Ilocos Norte Province. Further, the animals in each municipality bear serial numbers which are entered on the immunizing records, with owners' names.

A certificate of immunization is issued for each animal when released. This contains a printed outline of an animal, upon which are indicated brands and other distinguishing marks, together with description, name of owner, etc.

Animals accompanied by a certificate of immunization are exempted from any quarantine for rinderpest that is enforced by authority of the Director of Agriculture.

CONCLUSIONS.

1. The writers believe that their experience with simultaneous inoculation with blood drawn in the field has demonstrated that there is no necessity for maintaining an expensive permanent laboratory and herd for the production of antirinderpest serum from hyperimmunized animals.

2. A radical reduction in the cost of serum production has

been effected and in consequence the possibility of extensive employment of simultaneous inoculation in combating rinderpest has been demonstrated.

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NOTES ON SWINE BREEDING IN THE PHILIPPINES.

By Dr. W. R. L. Best.

Ever since the dawn of history swine have been known to exist in a wild state in many countries of the world. From these all of our many improved breeds or varieties are descendants.

The object of this article is not to show by what means these changes have been made, but to furnish proof, in a small way, of the ease with which the type of a certain kind of pig may be so greatly changed that the original conformation becomes so transformed as to be scarcely recognizable. The large Yorkshire hog was formerly known to be thick in the shoulder, to have a short nose, heavy jowl, wide and fat back, long legs, round and coarse bone, and a carcass of immense weight, mainly comprising lard, hide, and bone. The same breed, as we see it to-day, is an animal of a totally different type and character. He is fine in bone, deep in carcass, and carries much lean meat, weighs better in proportion to his size, and his meat is infinitely better and commands a much higher price.

Some of the determining influences that are occasionally stated to be important factors in this change of conformation are climatic conditions and the system of feeding and foods; therefore, one can not be surprised when the theory is advanced that the monetary affairs and mode of life of the inhabitants, combined with the climate and natural products of the soil, have almost a preponderance of influence on the kind of hog bred in any country. The hogs of Great Britain were improved through the introduction of Chinese and Neapolitan breeds crossed with native animals, and better food and improved care; those of the United States through animals obtained from Great Britain, skillful and select blending of different breeds, and improved management; while work of this nature in the Philippine Islands, so far, has been confined to crossing with the Berkshire breeds, which has brought about a marked improvement.

The classification of pure breeds of hogs in any country is a difficult task, but from a utility point of view it may be stated that there are only two distinct types: The bacon type is of a

long conformation and is noted for the production of bacon; the lard type is of a much shorter and broader conformation and is noted for the production of lard. To the bacon type the large Yorkshire and the Tamworth preferably belong, while for the lard type such breeds as the Berkshire, Chester White, Ceshire, Duroc-Jersey, Victoria, Poland China, Essex, and Suffolk are adapted.

COMMENCING A HERD.

For the production of purely market hogs as well as for the production of pure-bred animals for breeding purposes, good pure-bred animals, of course, would be the best. However, the man with limited means and perhaps also with limited knowledge as to the value of different animals, will be able to succeed, and succeed well, by starting a herd with native females crossed by pure-bred imported males such as Berkshire, Duroc-Jersey, or Yorkshire. This method, if properly carried out, giving the necessary attention to protection against invasion of diseases as far as possible, will afford the man with limited means an opportunity to get a good start, and, at the same time, will not be very expensive. The beginner should decide what kind of a hog he is going to breed. If raised for market purposes only, the native females crossed by pure-bred males may in some cases prove as profitable as all pure-bred animals. The man who has a well-selected herd of native sows and is producing hogs for the pork market by crossing with pure-bred boars will perhaps succeed just as well as the man who is producing pork hogs from an all pure-bred herd that have not been as well selected.

In selecting animals for breeding purposes many practical questions should be considered. As a general rule the animals selected should be large for the breed to which they belong, so if large litters of strong pigs are to be expected the sow must of necessity be long and wide, with sufficient width and depth of chest space. The back should be strong and well supported; a sagging back is very objectionable in breeding hogs.

Throughout the Islands the predominating color of hogs is black, which appears better adapted to the climate than light colors. In some tropical climates where the hog industry is fairly well developed, white hogs are not looked upon with favor, because they are more liable to be sun scalded and have other skin disorders. A good profitable sow must be prolific. She should raise at least two litters of pigs a year, with six or more in each litter.

Invariably it is the practice of hog raisers of the Islands

to pay little or no attention to the coming young brood sow, consequently nearly all of them are bred too young. Under no conditions should a sow be bred under eight or nine months of age. When bred too young they not only remain underdeveloped, but small litters of weak pigs will result.

The term prolificacy is used to apply to the number of pigs born. It is a valuable point in any breed. Although more or less an inherited characteristic, it is very largely controlled by the condition of feed and care of the sow. The brood sow that will produce twelve pigs and raise ten to a litter is more than twice as valuable as the sow that will produce seven pigs and raise five. If the one that raises five pigs per litter will pay expenses, then the one that raises ten pigs will have five pigs for the profit of her owner.

SELECTING A BOAR.

The choice of the sire is one of the most important of all the steps to be taken in connection with the successful breeding and rearing of any of our domestic animals. It may truly be asserted that with pigs a false step can be more quickly retraced than with animals such as the horse, or even with cattle, since the error can be more readily discovered owing to the shorter time in their reproduction; this, however, does not in the least lessen the urgent necessity for the greatest possible care being taken when starting a herd of pigs or when purchasing a boar for use in one's own herd and for the benefit of those of one's poorer neighbors who breed pigs and often trust to the returns from their one or two sows or from the fattening pigs for their living expenses.

The oft-quoted remark that "a bull is half the herd" applies to the raising of hogs. Be sure that the boar is the best that can be obtained; that he possesses all the essential good points necessary for a stock boar; and above all that he is pure-bred.

It is a generally accepted opinion that the male animals exert a far greater influence on the external points of the joint product than do the female parents, the latter in turn influencing the internal portions to a greater degree.

The points to be sought for in the selection of a male are compact frame, long and deep carcass, well developed hind quarters, wide chest, ribs well sprung, deep flanks, legs placed well outside the body, fine bone, pasterns short, neck muscular, head of medium size, wide between the eyes and ears, good disposition but bright and lively, and coming from a large litter, which indicates prolificacy.

CARE OF THE BOAR.

The age at which a young boar should be allowed to commence service depends largely upon the development and condition of the animal, but the consensus of opinion is that he should not be less than nine months old. It is a great mistake to allow the boar to run about with sows; accident to the other stock and to the boar are frequent when this is permitted, the boar frequently becoming savage, both with the sow and with the attendants. Also the vigor of the boar is impaired from the frequent and harmful service of the sows, which will continue with some sows for several days. The better plan is to keep the boar in moderately close quarters, and when the sow has been in heat a day or two, have her put into the boar's quarters and removed after one complete service. This will be found to be equally as effective as a dozen matings, while the strain on the boar will be infinitesimal, compared to the heating and excitement of being in the company of the sow during the whole period of her oestrum; besides this the boar's service can be made available for many times the number of sows. The number of sows a boar can serve depends largely upon his age and constitutional vigor.

CARE OF THE YOUNG PIGS.

This is one of the most important, and, to many persons, the most difficult of the departments connected with successful hog raising. There are more pigs lost or ruined when they are first weaned than at any other period of their existence. This, in the majority of instances in the Philippines, is not a factor of much importance, as most of the litters are allowed to run with the mothers until they become self-weaned. By this practice ordinarily only one litter a year can be raised. The age to wean pigs varies with the youngsters. Those that have made a rapid growth should be weaned when about eight weeks of age; or in case the pigs and mothers are not doing well, it may be wise to wean at a much younger age, even though the pigs are small. As a general rule it is safe to say the best age for weaning is between seven and ten weeks.

Many pigs are stunted for want of proper care the first month after weaning. They are frequently turned out to hot, dry pasture to forage for themselves, or placed in close, damp, muddy quarters. Animals thus treated of course do not make a satisfactory gain. For best results the pigs just weaned should be provided with shade, a clean mud wallow, and receive palay, camotes, mongos, beans, corn, or tiquitiqui in addition to the

pasture. There are three systems of weaning pigs that can be adopted: First we have the one of self-weaning, previously mentioned; second, removing a part of the litter, leaving some of the smaller ones to drain the udder; and third, removing all the litter. This last method is considered the best and the one most commonly practiced in advanced hog-producing countries. It has the advantage that all of the little pigs can be put on feed at the same time; they will be of the same age and can be fed to better advantage and will develop so as to produce an evener bunch of hogs, which will sell for greater profit. The sows also being weaned at the same time will come in heat during a comparatively short period, and having boars available, they may be bred again to farrow the next series of litters within a comparatively short time, so that this process can be continued indefinitely. Furthermore it is thought that a sow will breed more readily immediately after weaning the litter than she will at any other time.

One of the secrets of success in the rearing of weaned pigs is the frequent feeding in small quantities. Little pigs, when separated from their mothers, for the first few days should be fed five of six times a day. Anyone not thoroughly acquainted with pigs would be surprised at the very great number of times during the twenty-four hours a sow suckles her little pigs. For this there appears to be at least two good and sufficient reasons: One is that the sow is unable to carry a large quantity of milk for her numerous family and the other that the stomach of the pigling is not large enough to stow away any great quantity of food at one time.

When they are about three weeks old they will begin to show indications that they are acquiring appetites, at which time a small trough should be placed in one corner of the lot, so guarded by a fence that the old sow can not have access to it but the young pigs can. Into this pour a little feed three times a day but not more than the little fellows will eat or drink at once. Never leave food in the trough to sour, as digestive disorders and death are sure to follow.

It is a very common practice throughout the Archipelago to make use of the pig as a scavenger. This method is diametrically opposed to the fundamental principles of successful hog-raising, and should be vigorously opposed by every municipal and health official for sanitary reasons, if for no other. Diseases of various kinds are caused by this practice, which results in yearly losses of enormous sums of money and lack of good wholesome food for consumption.

PROPER AGE TO CASTRATE.

All young boars not intended for breeding purposes should be castrated. This should be done between the ages of three and six weeks, so that they will have recovered before time for weaning. The operation is very simple and can be performed by anyone. Simply slit the end of the scrotum and remove the testicles by pulling them out and cutting off the cords. Smear the edges of the wound in the scrotum with pine tar, to keep away flies, and let the pig go.

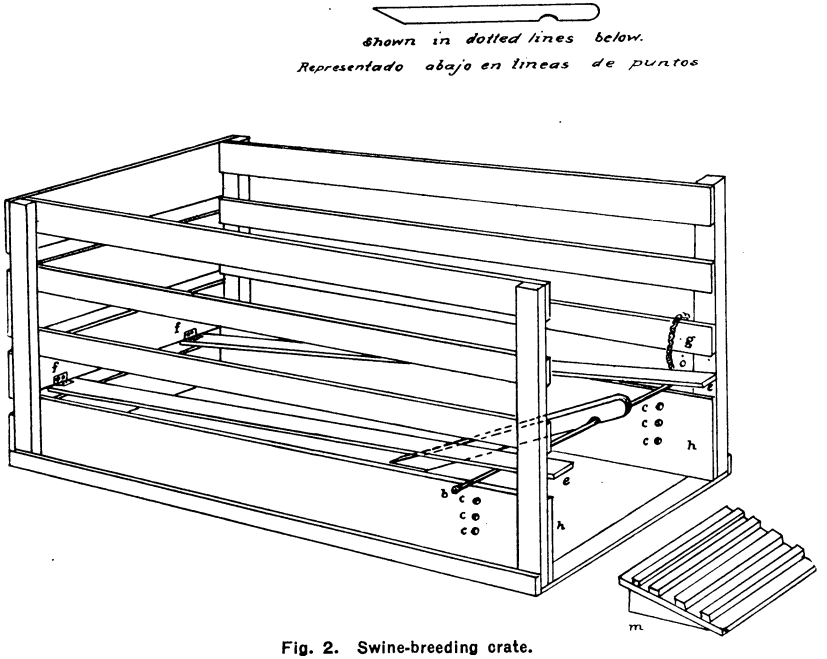

Fig. 2. Swine-breeding crate.

HOW TO MATE.

As a rule sows come in heat every three weeks; therefore, if the sow has been mated and for some reason has failed to conceive, she should make the fact known in twenty to seventy-one days after breeding. Often a person desires to cross a large heavy boar with a small sow, and vice versa. To facilitate this, the construction of a breeding crate will be found extremely useful. This crate resembles an oblong box with one end out. A convenient size is 6 feet (18.29 decimeters) long, 2 feet 4 inches (7.1 decimeters) wide, and 3 feet (9.14 decimeters) deep. The frame should be constructed of material 2 inches by 4

inches (5.08 by 10.16 centimeters), closed in front and open behind. Fig. 2 illustrates the improved type.

The sideboards are 10 inches (25.4 centimeters) high; through these, holes are bored at convenient intervals (*c, c, c,*) to admit the iron rod (*b*) which should pass close under the hams of the sow just above the hocks. The proper hole to use is determined by the size of the sow. A crotch support (*a*) is added, with a notch in it which passes between the sow's legs and rests on the retaining rod, as shown. This is 2 by 2 inches by 3 feet (5.08 by 5.08 by 91.44 centimeters) long, and the upper edges are rounded off smooth, so as not to injure the sow. The side supports for the boar (*e*) are made adjustable by hinging to one of the cross slats in front (*f*) and are raised or lowered from the back by means of chain (*o*) which passes over the top of side board, and fastens to a pin, or heavy nail (*g*). Put a chain on for each support. Two 3-inch (7.62 centimeters) boards, 6 inches (15.24 centimeters) apart, should be nailed over the top of the crate where the sow's head comes, to prevent her from climbing out. The platform (*m*) is used to raise a small boar high enough to serve a large sow.

BUILDINGS.

There are innumerable types of hog houses, all of which seem to have their advantages and disadvantages; however, of late years, in many localities the small individual hog house has become very popular. They are built to accomodate one sow and her litter.

Another type of house is known as the portable kind, which can be constructed economically, moved and located wherever desired. They are usually built of two kinds: The A-shaped, as shown in fig. 3, or the shed-roof shaped, as shown in fig. 4.

Of the two types of houses, the shed-roof shaped is probably the most preferable. It should not be less than 12 feet (36.58 decimeters) long, 8 feet (24.38 decimeters) wide, 7 feet (21.34 decimeters) high in front, and 3 feet (9.14 decimeters) behind. Doors should be provided in the front and rear, so that by opening them it makes a cool house. Another type of building, and one looked upon with a great deal of favor by large hog raisers, is the one shown in figs. 5 and 6.

This has been found to be particularly adapted to climatic conditions in these Islands, and persons contemplating going into the business on a large scale could have these buildings extended as long as they desire, using the one storeroom for all pens up to ten or twelve.

An estimate of most of the material needed for the construction of a hog house such as shown in figs. 5 and 6, with approximate cost, is as follows:

Posts:	
5 pieces yacal 4 by 4 inches by 10 feet	₱21.72
5 pieces yacal 4 by 4 inches by 8 feet	
5 pieces yacal 4 by 4 inches by 7 feet	
Studding caps on posts, 20 pieces guijo 2 by 4 inches by 16 feet	90.94
Studding for storeroom, 10 pieces guijo 2 by 4 inches by 12 feet	
Stall partition, 40 pieces guijo 1 by 12 inches by 8 feet	
Storeroom siding:	
15 pieces guijo 1 by 12 inches by 6 feet	
18 pieces guijo 1 by 12 inches by 8 feet	
9 pairs strap hinges	4.00
1 gross of wood screws	.15
20 kilos 30-penny wire nails	5.40
20 kilos 10-penny wire nails	5.40
12 barrels Portland cement	66.00
Total	193.61

No allowance has been made for sand or gravel. The roof should be made of bamboo and nipa or grass.

The yard.—The place in which hogs are quartered should be such as can be kept clean. A filthy and carelessly kept lot encourages disease by providing lodgment for germs, and constant cleanliness is the most effective means of preventing germ dissemination.

Some breeders favor the hog wallow, while others are much opposed to its use. There can be no doubt that filthy wallows are often a source of danger, nor can there be any doubt that once a cholera hog wallows in the water, all other hogs wallowing in or drinking this contaminated water are likely to contract the disease. However, to the healthy herd there can be no objections to the wallow, as many advantages are to be derived from it. During the heat of summer the hog cools mainly by radiation and a cool mud bath is very cooling; it cleans the scurf from the skin and enables the hog to find protection from flies. This wallow should be so arranged that fresh water may be added as needed, and to guard against germ infection a portion of coal-tar dip or creolin may be poured in occasionally.

A good plan to follow, where space is a secondary consideration, is to have two yards for each pen, one of which, while

furnishing a forage crop, can be used while the other is being cultivated and planted. As soon as the crop is eaten off in one

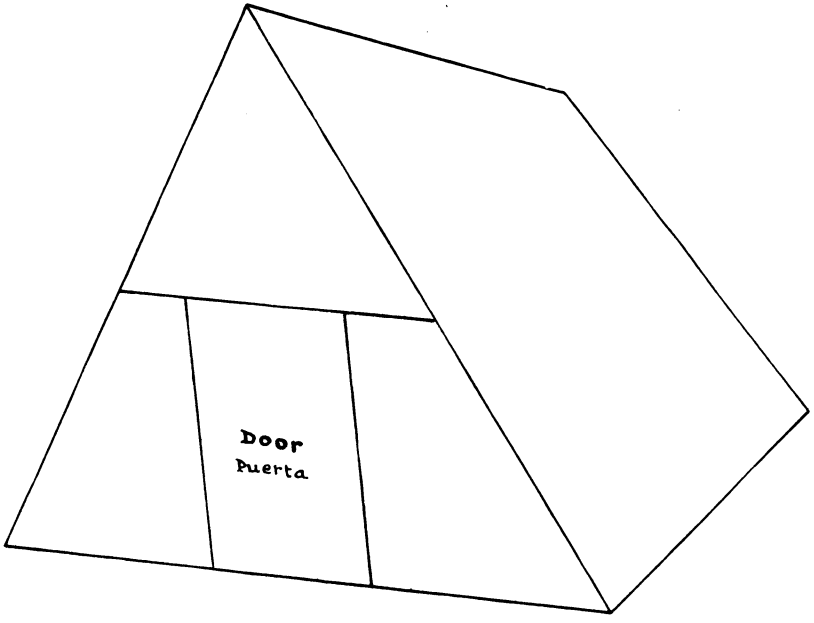

Fig. 3. Portable A-shaped house for swine.

yard change the animals to the other division, and cultivate and plant the one from which they have just been removed.

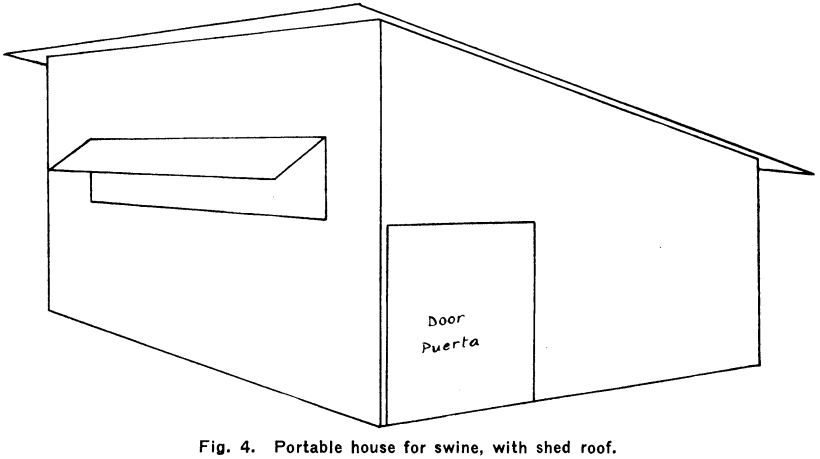

Fig. 4. Portable house for swine, with shed roof.

Feeding.—The question of hog feeding engages the attention of persons in practically all parts of the civilized world. In

some places farmers engage in the industry as a specialty; in others only enough pigs are reared to utilize the wastes on the farm. In many countries in which dairy farming is followed

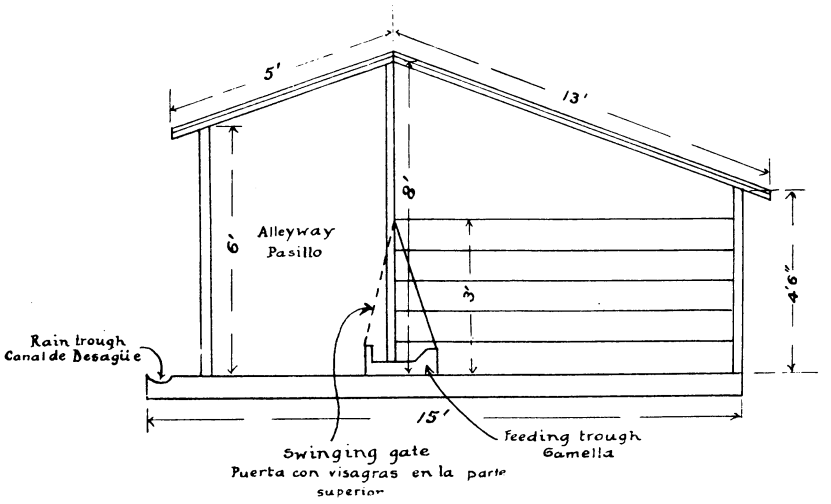

Fig. 5. Permanent hog house—cross section.

as the chief occupation, pigs are reared and fed in considerable numbers as an auxiliary industry.

While several different methods of feeding and management

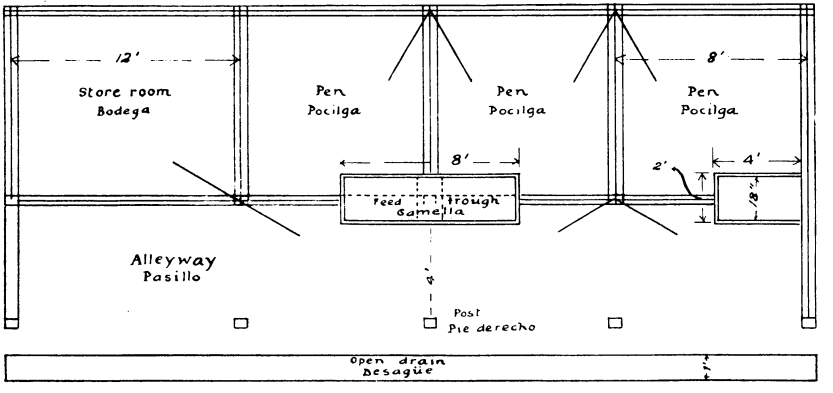

Fig. 6. Permanent hog house—ground plan.

are pursued with good results, certain principles in common are recognized as forming the basis of the work.

In general, pigs should be fed in small droves, and these

should be made up of individuals of the same age, as well as of the same size. If pigs of different size are fed together, the larger ones are likely to get more than their share, because they will crowd the smaller ones away from the trough.

As a rule hogs are fed twice a day, morning and evening. Some feeders give a noon ration. Conditions should modify this to a certain extent. If the pigs are on good pasture and get a portion of their feed daily from this source, they have free access to feed at all times. If a pig gets nothing except what is brought to him by the feeder—that is, if he is kept in a dry lot—the number of feeds per day is of greater importance.

Extensive experiments in methods of feeding have been carried on in many countries, with the result that the general consensus of opinion seems to show that hogs do better when fed the same quantity of food per day divided into three feedings, morning, noon, and night, than when fed in two feedings, morning and night.

Of the many varieties of foods found suitable for the hog industry, the following are the most common and important:

Grains.—Corn, palay, tiquitiqui, mongo, and beans.

Roots.—Camotes, peanuts, taro, chufas, dasheen, and cassava.

Fruits.—Banana, papaya, and copra meal.

Fodder.—Guinea grass, sugar cane, cowpeas, sorghums, corn, and peanut vines.

Many combinations of the various hog foods enumerated above are in use, all of which, if judiciously and properly fed, are of great economic value. Not a single item mentioned is an imported food, and nearly all can be grown in any locality throughout the Islands.

THE MOST COMMON DISEASES OF HOGS AS FOUND IN THE PHILIPPINES.

Cysticercus cellulosæ.—This is the most common of all diseases affecting hogs in this country. It is the condition resulting from the presence of tapeworm cysts in the flesh or muscles of animals. These cysts, when swallowed by human beings, develop into tapeworms. Hogs become infected by eating feces of persons infected with tapeworm. The vitality of the tapeworm cysts in pork can be destroyed by thorough cooking, hence raw or imperfectly cooked meat should not be used.

As mentioned in a previous paragraph, it is the common practice throughout the Islands to use the hog as a scavenger, which makes him an easy prey to infection by eating human feces. These feces, containing the eggs of the tapeworms, are carried

to the alimentary canal of the hog, where they hatch and migrate to the circulating system, which deposits them in muscles and other organs of the body.

The cysts, when seen in pork, are small pearl-shaped vesicles about the size of a pea and grayish white in color. They are most frequently found in the muscles of the head, heart, diaphragm, and tongue. It necessarily follows, then, that when examining a carcass for cysticerci, special attention should be paid to the muscles of mastication and the heart.

Because of the fact that pork infected with cysticerci, when eaten by men, produces tapeworms, all carcasses thus diseased should be condemned. In order to reduce to a minimum the chances of becoming infested with tapeworm, pork should not be eaten unless thoroughly cooked. The infection might even occur through a careless cook, by not having thoroughly washed cooking utensils or knives after having come in contact with raw meat. The most important preventative measure of all is the proper disposal of human feces.

The seventy-eighth annual report of the Bureau of Animal Industry of the United States of America for 1911 concludes, in an article on this subject, by saying, "That the prevention of tapeworm infection in human beings and of cysticerci in cattle and hogs is comparatively simple, and may be accomplished by the following means:

"1. An efficient meat inspection.

"2. Proper cooking of meat before it is eaten, particularly if there is any doubt of its freedom from infestation with cysticerci.

"3. Disposal of human feces so that live stock cannot have access to them, and so that there is no possibility of contaminating the feed or water supply of live stock."

Hog cholera.—This is a contagious febrile disease caused by bacteria gaining access to the system. It is characterized by fever, ulceration of the intestines and discolorization of the skin, especially in the regions of the sides and abdomen. After an animal has been exposed to the infection the first symptoms of the disease will appear in from seven to twenty days. The disease appears in two strengths, the chronic or mild form and the acute or strong form. When the acute form attacks an animal it lives only a few hours, but with the chronic form the disease runs a much longer course.

The disease is spread by allowing healthy and sick animals to run together, the well animals breathing the expelled air from the diseased ones; also by eating infected particles of food or virus. Any means that will cause the spread of the germs will

be responsible for the spread of the disease. Very often when a man has sick animals his neighbors come to offer advice, and by so doing they carry the germs away on their feet to spread in their own herds. Dogs and birds are also agents in carrying the infection from one place to another.

The symptoms are as follows: The animals become quiet, lie quietly in a corner or huddle together and refuse to move when disturbed. The appetite varies; there may or may not be diarrhea; sometimes the bowels are costive; and occasionally a cough is noticed. Frequently there is considerable reddening of the skin on the abdomen, ears, and on the inside of the eyes or nose.

As there has not been a satisfactory remedy discovered for the treatment of the disease, the only safeguard is prevention.

Although no absolute cure for hog cholera has yet been discovered, the use of a serum as a preventative has proved quite effective. In this treatment serum is obtained from a hog that has recovered from cholera, a single inoculation of which gives temporary immunity. The simultaneous method which produces permanent immunity consists of inoculating the animal with virulent blood and serum at the same time. This latter method produces a mild case of cholera from which the hog soon recovers. The expenditure necessary for the construction of a laboratory, buildings, equipment, salaries of experienced and trained men for this work, precludes the possibility of its use in these Islands at the present time.

The quarantine system has so far given the best results. In order to prevent a herd from contracting the disease after it has appeared in a locality, thoroughly quarantine all hogs. All animals should be so completely isolated from external communication that there will be no possibility of the germs being carried to them. If the disease appears in a herd, then each animal should be separated and isolated until such time as all possible means of infection have been cleared away; yards and buildings should be thoroughly cleaned and disinfected.

Kidney worm.—Dr. W. H. Boynton of the veterinary research laboratory, Alabang, Rizal, describes this infection as an infectious disease of swine, the cause of which is a worm 30 to 40 millimeters in length. They are found in the kidney, liver, spleen, glands, muscles, and connective tissues of both the abdominal and chest cavities. The disease is characterized by muscular pain, tenderness to pressure over the kidneys, weakness, loss of appetite, emaciation and partial or complete paralysis of the hind quarters.

The first noticeable symptom is a stiffness of movement, as if the animal is suffering from muscular pains. This is especially perceptible in the hind legs. As the disease progresses the animal becomes lame and weak in the loins. During this stage it lies down most of the time, and does not rise to its feet unless urged. In some cases, a few days before death, the animal loses partial or complete control of the hind quarters. There is tenderness over the kidneys, and the animal winces when pressure is applied to the back.

Since the worms are encysted in the solid tissues and are surrounded by a purulent débris, treatment with vermicides introduced by the mouth is very unsatisfactory. Remedies could never be expected to reach the worms in sufficiently concentrated form to have any beneficial action. Hence preventive measures are of more than usual importance.

Inguinal hernia.—This is a condition extremely common in young male pigs. It is the descent of a loop of the intestines into the scrotal sac. It is diagnosed by the enlargement of the affected side of the scrotum, the doughy feeling of the mass, and by the fact that it is reduceable, in the majority of cases, by manipulation, or by raising the hind quarters of the animal. These latter measures cause the protruded part of the intestine to pass back into the abdominal cavity, leaving only the testicle in the scrotum. If not treated, the growth of the animal is frequently stunted and the intestines become strangulated and cause death in a short time.

The treatment being purely surgical, it should never be attempted by anyone not having a knowledge of the method of operation. The animal should be suspended by the hind legs and an incision made through the skin directly over the enlargement. After the intestines have been put back into the abdominal cavity, the sac unopened, together with the testicular cord, are twisted up to the inguinal opening and a ligature applied close to the ring and fastened to the edge by sutures to prevent untwisting. Remove the testicle and suture up the wound; dress with antiseptics.

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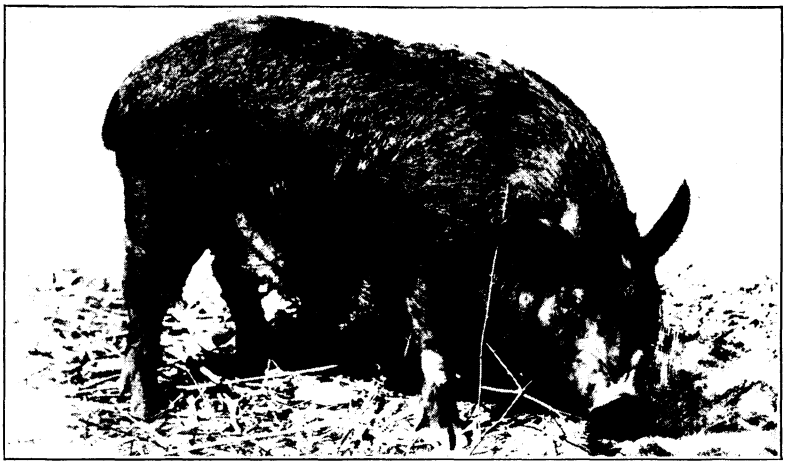
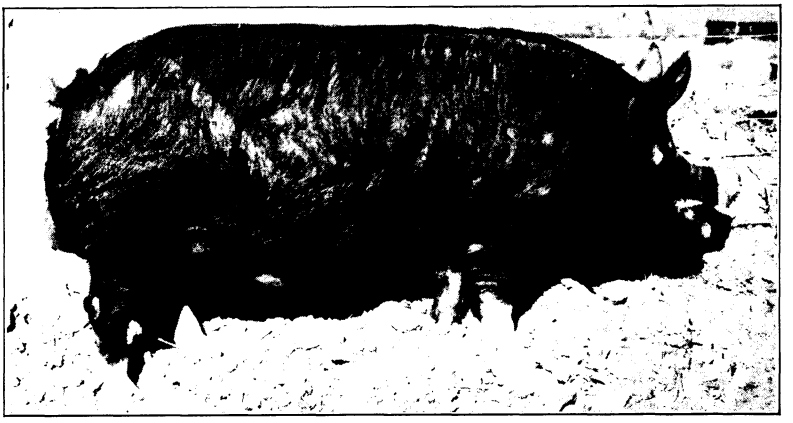


(*a*) Grade Berkshire sow; three-fourths Berkshire, one-fourth native.



(*b*) Berkshire boar imported from Australia in 1910.

(*c*) Berkshire sow imported from New Zealand in 1910.

(*a*) Duroc-Jersey swine imported from the United States in 1913.

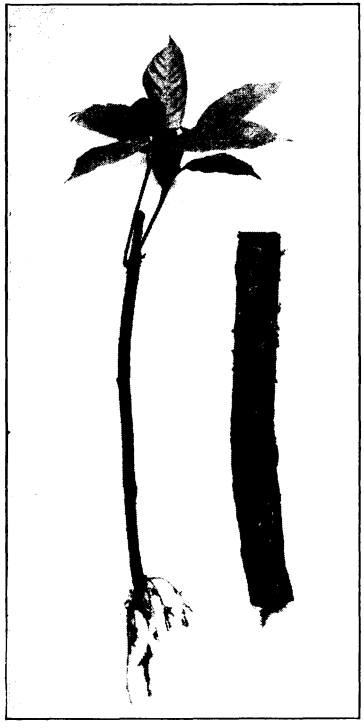
(*b*) Native pigs, Province of Batangas.

(*c*) Australian Berkshire hogs.

(*a*) Cacao shieldbudded at Lamao Experiment Station, 1913.

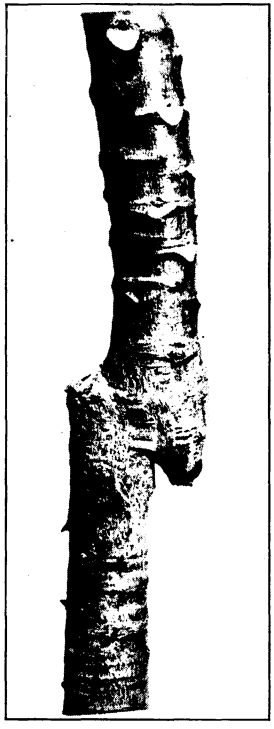
(*b*) Cashew, shieldbudded, Lamao Experiment Station, 1912.

(*c*) Tamarind, shieldbudded at Lamao Experiment Station, 1913.



(*a*) Rootcuttings of the seedless breadfruit, Lamao Experiment Station, 1913.

(*b*) Guava, shieldbudded in Subtropical Garden, Miami, Florida, 1909.



(*c*) Carica papaya inarched in Subtropical Laboratory, Miami, Florida, 1905.

OPPORTUNITIES IN PLANT IMPROVEMENT IN THE TROPICS.

By P. J. WESTER, *Horticulturist in Charge of Lamao Experiment Station.*

Some one has called the nineteenth "the century of inventions." When one considers the records of discovery and achievement in bioligical research of the current century, and the promising outlook for the future development in biological science, it would seem that, at least in a lesser sense, the temptation to call the twentieth "the century of biological evolution" is justified.

This does not mean that sight has been lost of the work accomplished in the centuries gone by, such as the improvement of grains by Le Couteur and Shirreff, the evolution of the sugar beet, or the thousands of varieties of temperate fruits, vegetables, and flowers, nor of the numerous races of domestic animals.

It is true that Mendel's law was discovered many decades ago; that Nilsson's discovery of elementary species was made in the last ten years of the nineteenth century; and that the labor that preceded the publication of his classical work, "Die Mutationstheorie," was conducted by De Vries in the last twenty years prior to 1900; but the practical application on a large scale of the principles embodied in the work of these men has been reserved for the twentieth century. The discovery of motile spermatozoids in the flowering plants was made shortly prior to the exit of the nineteenth century, and while Ciesielski's law of sex determination, the validity of which is still questioned by many, was discovered in 1878, it was not given to the public until in 1912.

Parthenogenesis in plants and among insects is a phenomenon that has long been known to the naturalist, but it remained for the twentieth century to witness the successful artificial stimulation of the female reproductive cell in animals, not only in those of the lower orders but even in a *vertebrate,* the frog. We read of the hybridization of the horse with various species of zebras, the gayal of Indo-China with several domestic breeds of cattle in Germany, the evolution of new types of sheep by the British in Africa, and of the successful crossing of the bison with domestic cattle in the United States, where we also have recently heard of fish breeding projected with a view of increasing size

and quality. Other examples of the advancing progress in biological research could easily be cited, but this should suffice. One can scarcely take up a current publication devoted to the natural sciences nowadays that does not contain a reference to some new discovery or research bearing on the subject under discussion.

If the new century is conceded to the biologist in general, it to a peculiar degree belongs to the plant breeder in the Tropics. In the Temperate Zone, that so long has been the home, we might say the cradle, of modern civilization, the cultivated plants have been for ages subjected to more or less unconscious breeding and improvement, and later, hybridization, the systematization of which has slowly increased until it has reached its present degree of perfection. The result of this monumental work, to which so many minds have contributed, is that there are now almost innumerable varieties of cereals, legumes, fruits, vegetables and flowers, many of which seem to defy further attempts towards perfection. Even forage plants are now the subject of breeders.

Comparatively few economics of the Temperate Zone have been exempt from the prying inquiries of the modern agriculturist, and plant improvement there is practically limited to the isolation of elementary forms in comparatively few species, and the recrossing of old cultivated varieties. The "limited number" of temperate economics is of course considered in contrast to the almost limitless number of useful tropical plants. Not that this statement is made with the intention of minimizing the importance of the work already done or under way by the breeder there, but rather to call attention to the enormous field that lies waiting for the thremmatologist in the Tropics.

Those nations that for any considerable time have occupied the Tropics have generally established magnificient botanical gardens, rich in useful as well as curious and ornamental plants; note for instance the collections in Buitenzorg, Java, in Peradeniya, Ceylon, in Singapore, in Kingston, Jamaica, or in Pará and Río de Janeiro, Brazil, to mention a few. Nevertheless, systematic attempts towards improvement have been confined to a handful of the most important species such as the sugarcane, rice, cassava, tea, coffee, nutmeg and cinchona—and even this work is of comparatively recent origin.

Pineapple breeding has been carried on by the British in the West Indies, but what is perhaps the most ambitious and the first project of any considerable magnitude undertaken for the improvement of tropical fruits was started some sixteen years ago by Webber and Swingle in Florida, under the auspices of the United States Department of Agriculture, in their hybridization of the pineapple and the citrus fruits. Twelve new pineapple varieties of very superior quality were produced in the course of this work; also a hybrid between the mandarin and the pomelo of excellent quality, two new mandarins, and a considerable number of hardy citrus fruits. The citrus-breeding work is now under the direction of Swingle, under whom it has during the last few years assumed very large proportions.

No one knows the origin of the numerous banana varieties, or those of the yam, the taro, yautia, the pineapple, or the older varieties of sugar cane. We necessarily accept them as mutations that have from time to time originated in the course of their domestication and which have fortunately been noted by some more than ordinarily observant individual and propagated—a procedure requiring little or no skill, thanks to the manner in which these species may be perpetuated vegetatively.

The exogenous tropical species that bear edible fruits are almost legion, but about the only ones of which there were recognized varieties, and which were authentically propagated vegetatively prior to 1900, are, as far as the writer is aware, the citrus fruits, the mango, the litchee, the carambola, the cherimoya, the granadilla, loquat, ciruela, and the seedless breadfruit. Since then the veriest beginning towards a scratching of the surface has been made, and practical methods have been worked out of asexual propagation of the cacao, the avocado, the soursop, the custardapple, the sugarapple, the biriba, the tamarind, the guava, and the cashew, and improvements have been made upon the time-honored methods of propagating the seedless breadfruit, the mango and the cherimoya.[1] A beginning has

[1] Vegetative propagation of a species is the first step towards the improvement of fruits, and the means of accomplishment of the standardization of fruit varieties. Plates I, VIII and IX show the success attained in vegetative propagation of some species by the writer that hitherto have been almost exclusively propagated from seed. Plate IX, b and c, are published by the courtesy of David Fairchild of the Bureau of Plant Industry, United States Department of Agriculture.

also been made towards the vegetative propagation of the pitanga, mangosteen and the chico.[2]

Several varieties of roselle have been isolated, the papaya has yielded to vegetative propagation and considerable advance has been made in breeding a papaya that will reproduce itself true from seed. Finally, some of the cultivated annonas have been hybridized, the first hybrid between the sugarapple and the cherimoya having fruited this month (October, 1913) at the Lamao experiment station. Very little has been done with tropical ornaments in their home with the exception of Hibiscus breeding, which within the last few years has been a project of considerable importance at the Hawaii Experiment Station, and where a large number of unusually fine varieties have been originated. In passing it may be said that the innumerable and gorgeous orchid hybrids that are extant have all been produced in the Temperate Zone. So have also the numerous canna, dahlia, and gloxinia varieties, etc.

This is a brief summary of the plant-improvement work that so far has been accomplished in the Tropics, infinitesimally little compared with the achievements along similar lines in the Temperate Zone, and vanishingly small when we consider the wealth of material. For instance, the family Annonaceæ contains at least thirty-one species that bear edible fruits, many already in their present state of unusually good quality. The family Myrtaceæ is a close second with the genus *Psidium,* which contains some 15 or more species with edible fruits, the *Eugenia,* also unusually rich in plant breeding material, and the related genera *Britoa, Campomanesia, Stenocalyx, Abbevillea, Bertholletia* and *Lecythis,* all contain one or more species that have edible fruits or seeds, two of which are more or less important in the world's commerce. There are quite a number of *Nepheliums* to draw from, not a few *Artocarpus,* and at least three *Dillenias;* nor should we forget the several species of the genus *Durio.* There is not the slightest doubt but that many a

[2] Firminger does indeed enumerate certain other species as being propagated vegetatively, but it seems likely that this was done on hearsay rather than after actual experiment or else it has been found unpractical, for subsequent authors from the same country, MacMillan, for instance, says that the same species are grown from seed. It seems unlikely that he would have been ignorant of the facts mentioned by Firminger if they were in practice. Writers on horticulture in India refer to the propagation of several species by means of marcottage or layering, but the practicability of these methods for at least some may be seriously questioned. At any rate they do not seem to have become generally adopted anywhere, notwithstanding that they were recommended many years ago.

traveler who has sampled the durian will enthusiastically agree that this fruit has urgent need of the thremmatologist. The tropical *Diospyri* are interesting at least, if not exactly inviting in flavor and aroma. There are several species of *Spondias* that might be greatly improved by reducing their seed and fiber, and the nearly related genus *Mangifera,* with some six edible species, offers interesting possibilities.

This may seem a large number, still no mention has yet been made of the numerous isolated species, whose botanical relationship precludes them from hybridization with other species having edible fruits, such as the chico, the choice-mamey, the lanzon, the avocado, the iba, and the ceriman.

So much for the fruits, but we may also anticipate the day when the individual rubber trees will be subjected to close scrutiny with the attendant selection and vegetative propagation. Some years ago when the United States Department of Agriculture took up the camphor investigations in Florida, it was found that the individual trees varied greatly in camphor content. The yield of quinine has also been found to differ considerably in individual trees of the same species. We may assuredly expect the same individual variation in the spice plants, and as their consumption increases and the cost of their production mounts higher, the means of increasing the profits to the producer are either *improved quality* or *increased quantity,* and here lies the opportunity of the plant breeder.

Lest we forget, there are still the tropical vegetables, grasses, and legumes, a beginning with respect to the latter having been made in hybridizing the velvet and the Lyon beans by Belling in Florida.

It would be easy to enlarge on the subject under discussion, but the above will at least in a measure serve to show the lavishness of material furnished by a generous Providence, and the large field of endeavor that here presents itself to the interested worker. We doubt if there is another field, equally virgin, where the work is more fascinating and more beneficial to humanity at large.

AGRICULTURAL POSSIBILITIES ON THE NORTH COAST OF THE ISLAND OF SAMAR.

By CHARLES H. MCILVAINE, *Catarman, Samar.*

The north coast of the Island of Samar lying on or near parallel 12½ north latitude, is about the middle of the Archipelago. It is southeast of the Island of Luzon and east of Masbate and its geographical position and topography are such that it receives the rains from both the northeast and southwest monsoons. As a result, there is no pronounced dry season here such as is common to most Philippine provinces. The annual precipitation is about 342 centimeters and is well distributed throughout the year. It rains more during the northeast than during the southwest monsoon, but one seldom sees a downpour of several days duration as usually occurs in provinces where the wet and dry seasons are distinctive, and, on the other hand, during the dryest season a week seldom passes without a good rain. Even during the recent great drought the abacá of this district suffered but little.

From the town of Allen on the west to Palapag on the east and extending back to the watershed, this section of Samar with its numerous fertile valleys, its well distributed and abundant rainfall, wonderfully productive soil, and fine healthy climate, is destined sooner or later to come into its own as one of the most productive agricultural centers of the Archipelago.

With the possible exception of mangos (and they do occasionally fruit here), anything that will grow at all in the Islands will grow remarkably well in this section. Hemp is the main crop at present and is of very good quality, but copra bids fair to supersede hemp in the near future. Cacao, coffee, and all citrus trees do well here, also rice, sugar cane, corn, piñeapples, and all manner of small fruits, and vegetables.

ABACÁ (MANILA HEMP).

The abacá raised here at present ranks high, but the quality could be greatly improved with a little more effort on the part of the strippers by doing away with the corrugated knife and allowing a little more pressure to the spring which holds the

knife upon the block. The Filipino laborer generally works on shares and his main idea is to produce the greatest amount of fiber with the least possible effort. The exporters could do considerable towards rectifying this malpractice by making a more rigid discrimination in the classes of fiber, but with the numerous unscrupulous small buyers engaged in the business it is

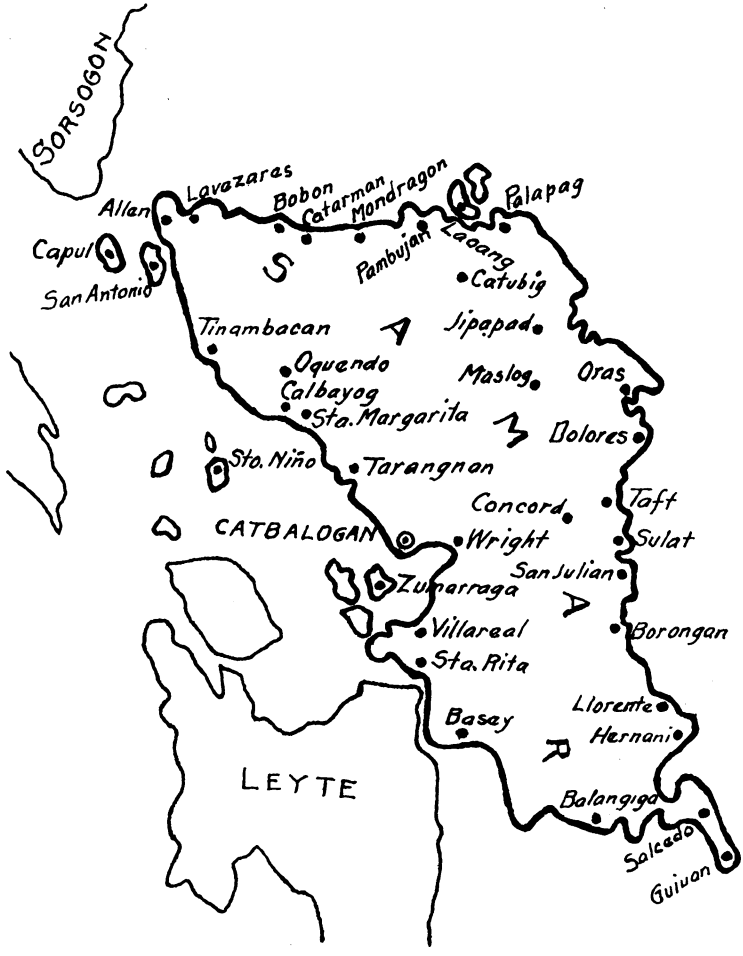


Fig. 7. Map of Samar.

doubtful if the conscientious producer would get the benefit of the better price.

There are here as in other abacá-producing provinces the usual number of different varieties of abacá. Most Filipinos are familiar with the peculiar characteristics of each kind, and with the proper selection and planting of only the most econom-

ical sorts the gross product could be greatly increased without materially increasing the area now under cultivation.

The system in vogue here of planting abacá is as follows: The land is first cleared by cutting down the underbrush and trees; when this material is sufficiently dry, it is burned off but no attempt is made to burn the larger limbs and tree trunks which are left upon the ground to rot; the abacá suckers are now set out by digging holes in the ground with bolos—just large enough to contain the sucker. No attempt is made to plant in straight rows nor are the stools placed equidistant from each other. Upon completion of the abacá planting, rice (upland) is planted on the same field. This is done by jabbing small holes in the ground with a pointed stick and throwing a few grains of palay in each hole. A crop of corn usually follows the rice harvest if the season is favorable. By the time the corn crop is harvested, the abacá shades the ground well and seldom receives any more attention until it is ready to cut.

One result of the high prices which prevailed during the past year has been that the Filipino, fearful of not being able to get such a good price again, has tried to produce as much as possible from his field at the time being by over cutting. This reprehensible practice has completely destroyed some fields and others have been set back a couple of years.

In contrast to the above, the writer recently experimented with a 12-hectare hemp field by pulling all stumps, thoroughly plowing and otherwise putting the ground in fine tilth before planting the abacá. In this field only selected stumps of the best local varieties were planted in straight rows 3 meters apart and the stools placed 3 meters apart in the rows, thus making it easy for subsequent cultivation. One man with a hoe cultivator has been able to keep this field in a fine clean state of cultivation at all times. This field is now six months old and surpasses any one-year-old field of hemp in the Catarman Valley. People come far out of their way to see this abacá and the method used in cultivating it, and neighboring Filipino planters have placed orders with the writer for seven American plows for use in their own fields. They are now convinced that clean cultivation is more economical not only in the matter of increased and earlier product but in upkeep as well. It is interesting to note in passing that some of the same men who are now buying plows were the most skeptical when the experiment was first undertaken.

COCONUTS.

Coconuts rank next to abacá in importance. From no export at all previous to 1908 to nearly 7,000 tons of copra exported from the town of Catarman during the year 1913 is some indication of how rapidly this new industry is developing—not to mention the enormous number of nuts used locally for cooking purposes and the trees tapped for tuba.[1]

More than a million new trees have been set out in the Catarman Valley during the past three years and the people here are just beginning to take a real interest in this product, abacá having heretofore occupied the farmers to the exclusion of all other pursuits.

There are still vast areas of choice coconut land available here at reasonable prices which could be made into beautiful and well-paying groves. With but a few notable exceptions the well-laid-out and well-kept groves are owned by foreigners or enterprising Filipinos from other parts who have seen the opportunity and have settled here to invest their capital. Of foreigners, there are at present twelve Americans, four Spaniards and a number of Chinese engaged in planting coconuts.

There are in evidence here the several varieties of nuts to be found in other coconut-producing provinces, some with yellow or reddish husks while still unripe and others of various shades of green. There seems to be small preference as to kind in the matter of meat, one sort giving about as much as another. There is one variety here, however, which is said to be more prolific than the others. The native name of this is "Gugobing" and it is claimed that this variety bears as many as twenty nuts to the fruit stem. The nuts are of large size, thin husk, and a good quality of thick meat.

What is true of abacá as regards seed selection and clean cultivation also applies to coconuts. A well-cared-for grove will yield fruit in its fifth year but those who put a nut in the ground and expect Providence to do the rest, generally wait nearly ten years.

CACAO.

Cacao has been growing here for a length of time beyond the ken of the Filipinos. Almost every country home has a number of trees nearby; nevertheless, although the trees are healthy and bear well and the cacao is of a fine flavor, no one has ever taken the trouble to plant enough even for his own use. The writer, with a small orchard of some two thousand trees, probably has

[1] A native wine.

the largest single planting in this section of the island. There are numerous well-sheltered valleys here which would be ideal for cacao orchards.

COFFEE.

Coffee has grown well here for many years and, to date, the diseases which have devastated the coffee plantations of other localities have not appeared in this section. There are quite a number of Filipino planters interested in coffee and they are extending their plantings as rapidly as possible. Experiments are now being carried on with Robusta coffee and it seems to be doing well.

RICE.

This coast has rice land sufficient to supply the entire province and still have large quantities for export, but the amount of rice grown here is negligible. The reason given for this is lack of work animals but this explanation is rather untenable in view of the fact that municipal records of the town of Catarman show that 40 head of carabao [1] were slaughtered in this municipality alone for meat during the year 1913. There were 26,173 cavans [2] of rice imported during the same period.

LABOR.

Owing to the small population, labor is a serious problem here in plantation work unless the planter is prepared to import his labor from some of the more densely populated islands such as Cebu or Bohol. Men brought in here under contract are more satisfactory as they live on the plantation and can be depended upon to be on hand when wanted.

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[1] This includes the month of November but the municipal treasurer is not sure the book shows all animals slaughtered.

[2] One cavan equals 75 liters.

CURRENT NOTES—MARCH.

NOTES BY O. W. Barrett, Chief, Division of Horticulture.

COTTON, AS A COCONUT CATCH CROP.

It is learned from one of the foreign collaborators of the Bureau, H. J. Smith, Esq., that New Hebrides cotton is bringing the high price of ₱230 per ton at the steamer's side. This cotton is grown by the planters of Tonga Island, South Santo, New Hebrides, as a secondary crop in coconut plantations, and at this high price there should be a very encouraging income from the field while the young coconuts are coming into bearing. Unfortunately, the Philippine planters cannot at present be recommended to plant cotton as a coconut catch crop. The up-to-date planter, however, will do well to make experiments with several tropical varieties of cotton; and if practical means of combating the insect and fungus pests here can be found it is quite possible that cotton will rank with maize as one of the best coconut catch crops of the Philippine Islands.

A FUNGUS PARASITE OF THE COCONUT BEETLE.

Dr. K. Friederichs, government zoölogist of Samoa, recently discovered at Apia a distinct case of parasitism of the rhinoceros beetle (*Oryctes rhinoceros*) by a more or less cosmopolitan fungus (*Chromostylim* [*Metarrhizium*] *anisoplioe* Sorokin). Spores of this fungus, which is becoming a very important factor in controlling the pest in some parts of Samoa, were brought to the Philippines in December by Dr. Friederichs and presented to the Bureau of Agriculture. Shortly after his arrival here he found what appears to be the identical species of fungus attacking larvæ of the rhinoceros beetle near the town of Lucena, Tayabas. Cultures of the fungus which appears to be nearly, if not quite, as virulent as the Samoan form, have been made and a considerable number of both larvæ and adult beetles have been killed in the breeding cages at the Singalong insectary and at the locust office in Intramuros.

It now remains to be seen whether this fungus can be propagated on a large scale and distributed to districts (and to

other countries) wherein the "Uang" still flourishes. It is quite possible that this fungus parasite will be found to be widely distributed in the Philippines and if so, it is undoubtedly a very effective, if not the principal factor in the way of natural controls which inhibit the spread of this beetle which commits such terrible ravages in the neighboring tropical countries.

A NEW IDEA IN BANANA CULTURE.

From an article in the Monthly Bulletin on Agricultural Intelligence and Plant Diseases for October, 1913, we learn that the natives of German East Africa are accustomed to feed their cattle (of which they maintain three or more distinct Zebu breeds) on banana stems during the dry season. One stem is considered sufficient food to last an adult animal one day. The natives, who are much more interested in stock raising than in agronomy, never attempt to make hay or store up any sort of fodder against a future need.

Presumably the stems are cut into very thin slices, since it would be almost impossible for an animal to eat a long strip of the leaf-sheath *au naturel,* on account of the tough fibers which would probably make trouble in both the mouth and stomach. The interesting point of the matter is that cattle can be kept on banana stems, and the prospective banana planter should take this matter under consideration. When mixed with some other food or even unsalable banana fruit, the spent stems from which bunches are cut could very probably be put through a slicing machine and fed regularly as "roughage" to cattle.

THE LARGEST INSECT.

A new species of Phasmid, or Walking Stick, (*Palophus titan* Sjöstedt) has just been described from Nyassaland, East Central Africa; this is believed to be the largest winged Orthopter in the world. The length of the body is, according to the Entomological News, about 26 centimeters (10⅓ inches). Near at hand in Borneo there is a wingless Phasmid (*Phobaeticus kirbyi* Redt.) which attains the greatest length of any living insect (33 centimeters, or about 13 inches). A Phasmid in the Bureau's collection from Baguio has a length of 17 centimeters.

In this connection it is interesting to note that there existed in the Coal Period in France a dragon-fly-like insect (*Meganeura monyi* Brongn) which had a body 35 centimeters long and a wing expanse of 64 centimeters (25⅛ inches); this was unquestionably the largest insect the world has ever seen.

A NEW METHOD OF MOSQUITO CONTROL.

In the Monthly Bulletin of Agricultural Intelligence and Plant Diseases for August, 1913, Dr. Chas. A. R. Campbell, of San Antonio, Texas, publishes a very interesting and probably quite original article on the control of mosquitoes by bats. Dr. Campbell constructs a special bat "roost," or shelter, near the swampy area to be ridden of mosquitoes, and finds that if properly built and protected from the enemies of bats, such as snakes, skunks, and opossums, the colony rapidly increases up to the maximum capacity of the shelter. Half a million bats of the small species can be accommodated in one roost.

A few figures, while, of course, not applicable in all cases, especially to tropical conditions, may be of interest. The small mosquito-eating bat, which is about the size of an ordinary mouse, consumes something like 500 mosquitos each night during the season. The guano produced by one bat during the ten or twelve hours of the period spent in the "roost" amounts to some 17 centigrams ($2\frac{3}{5}$ grains). Half a million bats, therefore, should produce in the eight months of the active season for mosquitos no less than 20 tons of guano; at ₱60 per ton the owner of the roost acquires first-class plant fertilizer to the value of over ₱1,200. This guano, carrying about 12 per cent of nitrogen, is a regular commodity in Texas, and it brings about ₱3 per sack of 45 kilos; this applies to cave guano which is manifestly much less valuable than the dry guano from the bat "roost," for the reason that there are very few caves which do not have more or less leakage of water from the roof which, of course, quickly dissolves out the ammonia from the deposit on the floor.

There is no question but that the Philippine farmer can utilize to very good advantage guano from any species of bat occurring in the Archipelago. The samples recently tested at the Singalong experiment station prove that bat guano collected in Manila is a first-class, perfectly safe fertilizer for vegetables and plants which require more or less "forced feeding," as it were.

To say the least, this scheme of killing two birds with one stone, i. e., turning insect pests into fertilizer, is well worth the attention of all kinds of agriculturists.

FIGHTING MOSQUITOS WITH "MILLIONS."

One of the severest hindrances to the rapid progress of agriculture, not to say advancement of civilization, is the mosquito pest. Millions of pesos are virtually lost every year in tropical countries through the effects of mosquitos; in fact, many of

the richest districts of the world are scarcely habitable by the white race on account of the mosquito-borne diseases.

A number of years ago a kind of very small fish, known as Millions, was enlisted in the war against mosquitos and in almost all cases splendid success has been the result. These little minnows, which seldom exceed 5 centimeters in length, are quite at home in shallow pools and ditches in which most of the species of mosquitos which carry diseases infectious to man naturally breed. One of these Millions can easily consume 300 to 500 mosquito larvæ in twenty-four hours. A few years ago Dr. Alvin Seale of the Bureau of Science successfully introduced these fish (*Gambusia*) into Hawaii, and more recently into the Philippine Islands. It is now learned that the Malay States are making earnest efforts to introduce these enemies of the pestiferous insects, 12 special shipping cases containing over 1,000 living fish having recently been brought over from Barbados, the original home of one of the best species, *Girardinus poecilloides.*

PROFITS ON COCONUTS.

The foreign investor who studies the coconut statistics of the Philippine Islands must needs draw a very disheartening conclusion therefrom. For instance, if he compares the average tree production in the Philippines—about 30 nuts per annum—with the average for other countries, say, 50 nuts per annum, he will necessarily see that there is something wrong with coconut culture in this country. But what will he think when he studies the figures which can be shown him by a certain planter in the Visayas, who is calculating his future output at one-half picul[1] per tree per year? Against the ₱1 or less profit per tree per year which may be taken as a general average here, what will he say to the fact that this up-to-date planter confidently expects and is actually getting in some cases, more than ₱7 per tree? A difference of 100 per cent in such matters is, of course, not by any means startling—nor even 200 per cent—considering the great difference in cultural practices old and new; but a difference of 700 per cent is quite another matter. In fact, it is a terribly derogatory commentary on the reprehensible practices which have been rampant so many years in this part of the world.

There seems to be no reasons for expecting the present very high price of copra to drop during the next few years; and there

[1] 1 picul equals 63.25 kilos.

is no reason in the world why a well-cared for coconut tree should not produce 100 nuts per year and if it is a vigorous well-started tree it will very likely give up to 150 or 175 nuts per year; there are, of course, plenty of trees that yield over 200 nuts per year right along. It requires for a picul only 250 nuts or less in the case of well-started trees having a diameter of 50 to 60 centimeters (instead of 25 centimeters as is usually the case); from vigorous trees only 200 nuts will be required; therefore one tree can easily turn out one-half picul worth at least ₱7, which means ₱700 per hectare per annum.

HORSE BREEDING IN JAPAN.

This industry is advancing rapidly in Japan and definite results have been obtained by the Horse Breeding Administration which has been established under the control of the Army Minister. According to an article by Prof. Sawamura Makoto, of the Imperial University of Tokio, in the September number of the Monthly Bulletin of Agricultural Intelligence and Plant Diseases, there are now three separate studs for horse breeding, one rearing-farm for foals and 15 stallion depots; this administration maintains six expert inspectors in this work. There are also 11 breeding studs belonging to local governments. About ₱250,000 is expended for these establishments.

The Administration maintains no less than 565 foreign and 551 cross-bred stallions, and 551 brood mares. This remarkably large number of stallions, as compared with the number in evidence in the Philippines, is distributed among 262 stations. A nominal service fee is charged for the superior stallions. The castration of foals is encouraged by the government, a premium of about ₱4 (4 yen) being given for each gelding. An interesting fact brought out in Professor Makoto's article is the existence of four distinct local breeds of Japanese horses, viz, the Hokkaido, the Nambu, the Miharu, and the Satsuma.

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

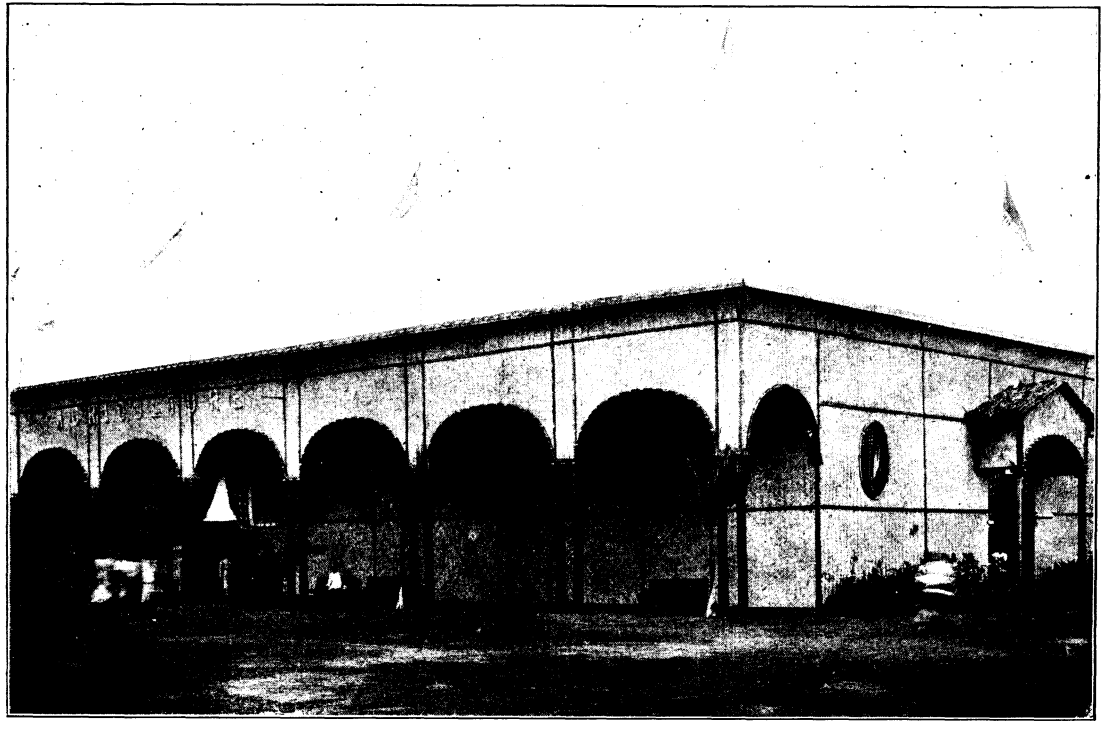
By the DIRECTOR OF THE WEATHER BUREAU.

DECEMBER, 1913.

(Temperature and total rainfall for 24 hours beginning at 6 a. m. each day.)

Date.	Abacá (Manila hemp).				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		San Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	27	------	26.2	7.4	26.4	------	27.6	------	24.9	25.4	26.3	------
2	26.9	------	25.7	38.9	26.2	------	26.9	------	23.9	19.8	26.8	------
3	27.5	------	26.7	4.6	26.2	------	26.9	------	24.9	21.6	27	------
4	27.4	4.8	25.8	35.1	26.6	------	26.8	36.8	22.4	33.4	27	1.3
5	26.4	5.4	25.3	1.3	26.7	2.8	27	------	21.3	8.8	26	------
6	27.1	.3	26.7	2.5	26.4	------	25.6	------	21.9	56.7	26.2	------
7	27.3	4.3	25.1	21.5	26.2	6.6	26.4	------	21.6	78.3	26.9	------
8	26.8	1	25.4	15.5	26.2	------	25.8	------	22.5	1.1	26.6	.5
9	26.4	10.4	25.7	10.4	26.4	2.3	26	------	23.4	------	27.2	------
10	25.3	15.4	26.2	5.3	26.5	15	27.4	------	23.2	2.6	26.2	------
11	27.1	3.3	26.1	------	26.6	------	26.4	------	23.5	3.5	26	------
12	26.4	28.8	26	8.6	26.7	------	27.6	------	24.8	4.3	26.6	------
13	26.8	13.4	26.3	18.7	27.1	10.5	25.8	.8	24.8	.5	26.9	------
14	25	17.8	25.6	13.2	26.3	------	26.2	------	24.8	------	27.4	------
15	26.4	12.9	25.4	9.1	26.6	.8	27.8	------	24.7	------	26.3	------
16	26.8	2	26.4	11.2	26.9	------	26.6	------	25.4	36.1	28.1	------
17	24.7	38.7	26.4	5.6	26.8	------	25.9	3.8	22.7	7.9	27.9	------
18	26.3	4.1	26.8	13.2	26.6	------	26.8	------	22.3	2.2	28.1	------
19	25.8	58.1	24.8	37.3	26.8	------	26.4	------	22.7	------	27.4	------
20	26	11.9	25.8	12.5	26.3	1	26	------	23.4	------	27.3	------
21	26.2	4.8	25.2	13.7	25.6	------	25.3	------	24.8	------	27	------
22	25.7	16.9	26	8.1	26.7	------	26.9	------	25.1	------	27	------
23	26	7.9	25.7	4.1	26.6	------	27.6	------	24.2	35.9	27.6	------
24	26	4.4	25.4	22.4	26	------	27.2	------	22.7	26.5	26.8	------
25	26.6	------	26.4	2	26.5	.5	26.2	------	24.3	------	27	------
26	26.3	1.3	25.9	5.3	26.8	------	26	------	24.6	3.3	27.6	------
27	25.5	------	25.7	1.6	26.8	.8	27.8	------	23.1	13.5	26	2.8
28	25.8	------	25.7	3.6	25.8	------	26.2	------	22.8	------	25	------
29	25.3	24.4	25.7	.5	25.8	------	26.7	------	22.4	.3	25	------
30	24.2	61.4	25.7	4.3	26.6	23.9	26.8	------	23.3	4.5	25.8	1.5
31	24.8	5.6?	25.6	1.3	25.4	------	25.6	------	20	24.1	25.4	------

PLATE I.



Agricultural Building, 1914 Philippine Exposition.

EXPOSITION NUMBER

THE PHILIPPINE

Agricultural Review

VOL. VII APRIL, 1914 No. 4

CONTENTS.

ILLUSTRATIONS.

EDITORIAL.

THE SECOND PHILIPPINE EXPOSITION.

The Exposition fire is now a matter of history. Thanks to the enthusiasm and perseverance of the provincial authorities as well as the Exposition Board, this grave disaster did not prevent the holding of a highly creditable exposition. A few figures, however, will show that in the way of provincial and individual exhibits only a mere modicum was left.

Approximately ₱100,000 worth of individual and provincial exhibits were lost on January 26. Of this large sum, about ₱30,000 represented the value of the provincial exhibits. Of the 24,500 square meters of area for buildings in the original plan only about 10,000 square meters was left intact. Fortunately the Exposition Board carried insurance for ₱50,000, sufficient to cover the losses of the provincial governments and leave something for emergency operations, reconstruction work, etc.

The special appropriation of ₱60,000 to go toward reimbursing individual exhibitors was a very good thing so far as it went, but the really serious fact was that a large percentage of the materials lost could not be duplicated in anything like the time left between the fire and the postponed opening of the Exposition on February 7.

Of the 38 provinces, 29 carried out their original plan, in most cases on a much reduced scale, of exhibits; 4 provinces had not attempted to send exhibits and 5, partly through transportation difficulties and the small amount of time permitted them to collect new materials, were obliged to relinquish their hope of participating in the Exposition.

THE PROVINCIAL EXHIBITS.

By O. W. BARRETT, *Chief, Division of Horticulture.*

The following notes on the more attractive features of the exhibits entered by the provincial governments are written not as a complete report but as a very brief summary.

Agusan.—There were still a few excellent table tops left out of the very large collection lost in the fire. The principal feature of this exhibit was the Manobo and Bukidnon cloths and garments, many of striking pattern and color combinations. Starch of cassava and the wild palma brava and sago from the wild sago palm of the Agusan Valley were also in evidence.

Albay.—Though most of this province's excellent exhibits were burned, there was still a good display of abacá, sinamay cloths, and a loom; the process of beating pinolpog drew constant attention. Pili nuts were, of course, in evidence and the excellent candy therefrom, seen in the making, was much appreciated.

Ambos Camarines.—Of the highly valuable exhibit sent by this province there remained only a few specimens of the rattan chairs, a fairly good lot of jusi, piña, and sinamay cloths, and one sinamay loom. The exhibit of the Paracale gold mine was in the Bureau of Science area.

Batangas.—An excellent display of embroidered cloths and native goods, with five old table altars, carved and inlaid, and two looms for jusi cloth were in evidence. Abacá in the rough and in knotted hands (of which this province turns out 2 million pesos' worth per year) was also featured.

Bohol.—This province had a good exhibit of sinamay cloth and looms, an attractive exhibit of pearl shell, and a fair lot of vegetables. The cage of six live colugos, or "kagwangs," drew a crowd throughout the Exposition; some 300 skins of this rare and beautiful animal, worth ₱2 to ₱3 each, were lost in the fire. Bohol expects to become the principal maguey-producing province in the near future, but its excellent exhibit was destroyed. A fair collection of hats, however, was in evidence. Several tons of the Tinampay yams, for which this province has long been famous, were exhibited.

Bulacan.—A good display of hats, textiles, chairs (including some of wonderfully carved ebony), engraving stones, musical instruments, picture frames, and cabinetwork were well displayed. A live fish and turtle exhibit drew much attention. The roof of this large booth was composed of hats and mats.

Cagayan.—This province had a splendid display of tobacco and cigars in the making in the Bureau of Agriculture building; all stages in the process from stringing leaves on the sticks for curing to rolling the finished cigar were in evidence.

Capiz.—The famous Romblon marble was the most striking feature at this booth. "Chinelas" (slippers), hats, embroideries, and native cloths were well displayed. Thousands of pesos of valuable fabrics and spools of abacá thread in great quantity were destroyed in the fire.

Cavite.—The most striking feature of this booth was a model of the Earnshaw dry dock. Fairly good collections of fruits and vegetables were still in evidence. A finely decorated ceiling made of rice, mongo, and maize grains with cassava pith, maize silk, and feathers attracted considerable attention. Some fairly good coffee, bottled honey, and bottles of patis, or shrimp sauce, and bagoong (a native sauce) were also exhibited. The window shells, for which this province is famous, both in the rough and painted, made a good display.

Cebu.—The native cloths and shells were well displayed; the cutting and carving of the latter by skilled workmen was in progress. Mineral water from a natural spring and carabao cheese in the making were also exhibited.

Ilocos Norte.—As a grim reminder of the fire which wiped out the exhibit of this province, there was left, in the Bureau of Science exhibit, a very interesting lot of the excellent asbestos found in this province.

Ilocos Sur.—Cabinet-making, harness-making, and metal-working operations drew considerable attention. The ceiling, composed of long strips of various patterns of cloth, was a striking feature. There was a fair display of yams, fruits, sugar, and even a little coffee and kapok escaped the fire. Soap made from gogo (*Entada scandens*) bark was of much interest.

Iloilo.—Most of the jusi and piña cloths which have made Iloilo famous were destroyed in the conflagration; however, a beautiful ceiling of these fabrics was still in evidence. There was also a fair display of tobacco, maize, abacá, rice, copra, sugar and even Guinea-grass hay.

Isabela.—Naturally this province showed the finest hands

of tobacco at the Exposition. There was also a good collection of manufactured tobaccos and a large number of growing plants of various selected sorts. Several well-made table tops and numerous decorated mats were displayed.

Laguna.—The excellent exhibit made by this province deserved the highest praise. There was an excellent show of vegetables, both fresh and preserved, coconuts and copra of the very best grade, a fine exhibit of abacá rope, embroideries, native fabrics, grains, etc. The remarkable exhibits of yams, taros, yautias, dasheens, sweet potatoes, maize, etc., entered by the students in the College of Agriculture, were displayed in booths in the agricultural building.

Leyte.—Two jusi looms and a fair collection of native fabrics were shown; also a private exhibit of perfumes and powders, some ylang-ylang oil worth ₱120 per kilo, forming an interesting feature of this booth. Volcanic sulphur was also in evidence.

Mindanao-Sulu.—In the foreground of this exhibit were displayed samples of the Basilan Pará rubber and both raw and cleaned gutta-percha from the Cotabato Valley. Pearls, pearl shell, and a set of pearl-diving apparatus drew much attention. A collection of oils was shown as a private exhibit. Models of a Moro fish trap, house, and prao occupied one side of the booth. There was also a good display of textiles, baskets, and Moro arms and metal work. Some interesting citrus fruits and a huge specimen of A-1 almaciga were also in evidence.

Mountain.—Though nearly all of the wonderful exhibit sent to Manila by this province was destroyed before the opening of the Exposition, there was still a good display of silver, brass, and iron work, and native cloth; several of the small looms peculiar to the Mountain people were in operation and attracted large crowds.

Nueva Ecija.—This province lost 360 varieties of rice in the fire. A fair display of tobacco, coconuts, yams, sugar, and an excellent sample of cacao were shown. A private exhibit of roselle jelly, sauce, and sirup attracted considerable attention and proved that this crop has come to stay.

Occidental Negros.—The two walls of the booth were composed of the purple sugar cane for which this province is famous. Native cloth, musical instruments, and embroideries in the making were shown. Sulphur from Kanlaon Volcano, tobacco, sugar, and yams were striking features.

Oriental Negros.—Some excellent copra from probably the

best large coconut plantation in the Philippines drew considerable attention. The walls were covered with buri sugar bags. Rattans and bales of gogo (*Entada scandens*) were also displayed.

Pampanga.—This province had the best collection of fruits and vegetables at the Exposition. There was also an excellent display of cabinetwork, harness, embroidery, musical instruments, preserves, rice, tobacco, and vino [1] and tuba products. A fine exhibit of potted begonias attracted the horticulturist's attention. A jusi loom, a magnificent calesa, and two brass-bound chests were shown. A private exhibit of biscuits and "turron de Guagua," made with cashew nuts and honey, attracted attention.

Pangasinan.—This province displayed the best collection of native hats; there were also good specimens of the Bolinao mats and a beautiful display of carved and polished coconut-shell bowls. A model of the old Mangaldan indigo dye plant was shown.

Rizal.—Several of the native industries for which this province is becoming famous were well displayed. The Binangonan cement rock, kaolin for pottery, iron ore, coal, gold, and paving and building stones held the attention of the geologist, while a good collection of vegetables, samples of locally manufactured chocolate, sugar, rice, root crops, etc., attracted the horticulturist. A hemp-braiding machine was in operation and served as an object lesson to other provinces which will probably soon follow the example set by Rizal. An interesting collection of birds' eggs, an apparatus for making the famous Lambat fish nets, leather work, a loom, etc., were all worthy of inspection.

Samar.—There was a striking display of the mats and baskets for which this province is famous; not only were there *portrait* mats but one exceptionally large represented a map of the Western Hemisphere. Native embroideries, fabrics, chinelas, etc., were, of course, in evidence but of the 200 kinds of agricultural products, beside 210 varieties of rice, only a few root crops (including the palauan, the largest cultivated aroid), sarsaparilla, and a few other fruits and crop products were left. The valuable St. Ignatius beans, of which this province alone is the producer, were lost in the fire. Some extra fine almaciga (copal) and the best beeswax at the Exposition were in evidence. A fine lot of bejucos was displayed.

[1] A fermented liquor.

Sorsogon.—A good collection of vegetables, fruits, yams, and a large supply of pili nuts (of which this province exported some ₱52,000 worth last year), sponges, salt, almaciga, and some of the whitest cane sugar at the Exposition were in evidence; also a good collection of fabrics, and, though most of the pearls and shells were burned, a few good specimens were still left. Gold, also, from the Colorado mine, was a striking feature.

Surigao.—Native cloth and embroideries, cabinetwork, and a few sad reminders of the fire remained to this province. Most of the rare woods, including the ebony-like mancono, in over 35 varieties, together with half a ton of hemp and 15,000 coconuts were burned. The rear of the booth was a sort of menagerie containing a deer, a live iguana, a large white mongoose, a hornbill, and another specimen of the avifauna of this comparatively unexplored province.

Tarlac.—A fairly good collection of vegetables, many in tubs and pots, caught the eye in the well-arranged booth. A good lot of native cloth, mostly cotton, and one loom for weaving this were in evidence. Tiles, pottery, and a good collection of rice were all that remained of the expensive exhibit gotten together by this province.

Tayabas.—Hats (of which this province manufactures about 1 million pesos' worth per year), and silugut, or sinamay (native cloth, of which nearly half a million pesos' worth is produced here annually) were meagerly represented by a few left-over samples, most of the excellent exhibit being lost in the fire. Copra, lumbang, sugar, rattan, pili resin, etc., were displayed. A bejuco (rattan) said to be 125 meters long was in evidence.

Union.—Some extra large hands of tobacco, a fair collection of yams, some very large sincamas, excellent squashes, citrus fruits, and some 25 sacks of rice were all that was left of the large exhibit sent by this province. Unfortunately the collection of oils made from a great variety of oil seeds indigenous in Union Province was lost. A few tampipis (baskets) and a fair collection of native cloth (cotton) with a loom for weaving this were left. An elegant flat-topped desk of tindalo occupied the center of the booth.

In short, the twenty-nine provinces that went ahead, in spite of their heart-breaking losses in the fire, and put up a first-class set of exhibits deserve great credit for the success which crowned their efforts.

LIVE-STOCK EXHIBIT.

By C. W. EDWARDS, *Chief, Division of Animal Husbandry.*

The Insular live-stock exhibit idea is comparatively new to the Philippine Islands, having its inception with the exhibit held in connection with the 1910 Carnival.

In conducting an affair of this nature it is necessary to cope with many adverse local conditions not encountered in countries where live-stock raising is a well-established systematic industry. In the latter there are many producers of high-class breeding stock who are eager to exhibit their animals in the hope of winning simply a diploma or prize ribbon because of the benefits accruing from the advertisement gained thereby, while in this country each stockman owns a comparatively small number of utility and meat animals only for which he finds a ready market. There is also the novelty of the exhibit idea, lack of transportation facilities, and many other mitigating factors to contend with.

In spite of these conditions, however, a comparison of the recent live-stock and poultry show, held in connection with the 1914 Philippine Exposition, with the two previous exhibits of this nature reveals a very satisfactory progress, denoting that efforts put forth in this direction are being rewarded in stimulating a growing public interest for more and better live stock.

Although the housing accommodations of this year's show were much more extensive than those provided for previous exhibits, owing to the large number of public animals presented, there was only available space sufficient for two Bureau of Agriculture entries, which entries have heretofore composed a large portion of the exhibit. It was also necessary to reject a large number of late entries owing to lack of sufficient space.

The exhibit was held under the supervision of the Bureau of Agriculture with the assistance, in connection with the poultry division, of the Poultry Association; the Exposition Board provided the buildings and defrayed the expenditures incurred in connection with the care and maintenance of the animals while on exhibit and transportation expenses on provincial entries.

Among the classes of large animals, the horse section with some sixty entries making up twenty distinct classes composed the largest and perhaps the most popular section of the exhibit. The standard aggregate excellence was higher than that previously attained, reaching the superlative among the native and grade or mestizo classes, three years or over. In this connection the increase in number of grades or crosses lends an encouraging feature as indicating a public awakening to the necessity of the use of improved blood as a factor in upgrading the native stock. Of the imported classes, W. H. Fell led in number of entries presented.

In the cattle and carabao section, although the number of entries were few as compared to the number of horses, some very good specimens were on exhibit. The carabaos comprised three classes, representing native, grade, and Indian types, while among the cattle were some very good dairy and beef animals, totaling nine separate classes.

A very popular and interesting feature of the show was the large exhibit of swine. The specimens of pure-bred Berkshires, Duroc-Jerseys, Chester Whites, and Yorkshires would prove a credit to any live-stock exhibit. Duroc-Jerseys were on exhibit for the first time in this country and attracted no little attention from the many attentive visitors. The largest number of entries of Berkshires were presented by Mr. E. Wickham, with Mr. J. R. Kuykendall as the largest exhibitor of Chester Whites. The grade classes were interesting as demonstrating the facility and extent to which the native stock may be upgraded by even the first pure-bred cross. The general interest among live-stock growers in this class of stock was evinced by the surprisingly large number of sales that were made during the exposition.

Pure-bred Merinos and Lincolns comprised the total of presentations in the sheep department. The coarse-wool Lincolns, contrasting markedly with the fine wools, were here seen on display for the first time. It has been demonstrated that the Merino makes a very satisfactory cross with the native sheep. Although sheep raising has never received the attention that other lines of stock raising have, there is a good local demand for mutton and even in cases where small flocks are maintained means of upgrading should certainly be adopted.

The committee in charge of the poultry exhibit and exhibitors in general should be highly complimented for the very creditable showing made in this division. A total number of 125 entries were presented representing many different breeds and varieties. Among these the White Leghorn, Plymouth Rock, and Cochin

classes were an exceptionally good lot. Mr. J. Ishikawa, Mrs. A. J. Neal, and Mr. B. Fernandez presented the largest number of entries in the Plymouth Rock classes; Mr. Fernandez was awarded a silver cup, donated by the American Hardware and Plumbing Company for the best all-round display. If any criticism were to be made of the exhibit as a whole, it would be that with many of the birds presented, although good specimens, no attempt had been made to place them in show shape. In this division, special exhibits of incubators and brooders were presented by the American Hardware and Plumbing Company, medicines and disinfectants by the German Dispensary, and poultry accessories by "The Fair."

One pleasing feature of this year's exposition was found in the large number of provincial exhibits presented. The entries of horses from Batangas Province and carabao and cattle from the Province of Nueva Vizcaya are deserving of special mention, and the provincial officials and exhibitors of these provinces deserve a great deal of credit.

The following is a list of the committees in charge of arrangements under the various classes. A great deal of the credit for the success attending the exhibit was due to the activity and efforts of these members:

HORSES.

Mr. Mauro Prieto, 964 San Sebastian, Manila.
Mr. F. Lichauco, 817 Jaboneros.
Mr. R. Sharp, Macondray & Co.
Mr. W. H. Fell, 1955 Azcarraga.
Dr. J. A. McKinnon, Land Transportation Corral.

CATTLE AND CARABAO.

Mr. J. Pujalte, 1063 M. de la Industria.
Mr. Jacinto Limjap, 430 Estero Cegado, Santa Cruz.
Mr. E. Evangelista, 808 Clavel, Binondo.

SWINE, SHEEP, AND GOATS.

Dr. Gerald McKay, Australian Machine Dairy.
Mr. E. Wickham, 1285 Santa Mesa, interior.
Dr. Benito Valdez, 964 San Sebastian, Manila.

POULTRY.

Mr. A. L. Barden, 717 Kansas Avenue.
Mr. Baldomero Fernandez, 881 Isaac Peral.
Mr. E. F. Cheney, 1127 Leveriza, Malate.

On Wednesday the winners in the various classes were selected and the prizes awarded. An evidence of the ability and fair-

mindedness of the judges who very kindly served in this capacity was found in the fact that satisfaction was expressed by exhibitors in general with the decisions as made. Gold and bronze medals, diplomas, and prize ribbons were awarded as premiums.

Following is a list of the judges of the respective sections:

HORSES.

Dr. J. A. McKinnon, Vet., Land Transportation Dept.
Dr. A. Mitchell, Vet., 2nd Field Artillery, Camp Stotsenburg.
Mr. J. J. Barnes.
Mr. Mauro Prieto.

CATTLE.

Mr. Jacinto Limjap.
Mr. J. Pujalte.

SWINE.

Dr. F. C. Gearhart.
Mr. S. Durham.
Mr. W. H. Fell.

SHEEP AND GOATS.

Mr. R. M. Radtke.

POULTRY.

Mr. Rupert Fergusson.
Chief G. Seaver.
Mrs. A. J. Neal.

Below is given a list of the winners of prizes in the various classes:

HORSES.

CLASS A.—Coach type:
Geldings any age—
First prize.—W. H. Fell, 1955 Azcarraga, Manila.
CLASS B.—Light harness:
Stallions 3 years or over—
First prize.—Jos. Dorell, Zamboanga, Mindanao.
Second prize.—Pedro Alario, 515 San Sebastian.
Stallions 1 to 3 years—
First prize.—Oscar Hunt, San Lazaro, Manila.
Mares 3 years or over—
First prize.—Mariano Syyap, 21 Escolta, Manila.
Second prize.—John Giloy, 405 Real, Pasay.
Mares 1 to 3 years—
Second prize.—John Giloy, 405 Real, Pasay.
Geldings—
First prize.—W. H. Fell, 1955 Azcarraga, Manila.
Second prize.—W. H. Fell, 1955 Azcarraga, Manila.
CLASS C.—Brood mares:
Foreign breeds, any age—
First prize.—W. H. Fell, 1955 Azcarraga, Manila.
Second prize.—W. H. Fell, 1955 Azcarraga, Manila.
Native, any age—
First prize.—Miguel Lorzano, Lipa, Batangas.

CLASS D.—General purpose:
Stallions 3 years or over—
First prize.—Pedro Alario, 515 San Sebastian, Manila.
Second prize.—Jos. Dorell, Zamboanga, Mindanao.
Mares 3 years or over—
First prize.—Lieut. Dawley, Camp Stotsenburg, Pampanga.
Second prize.—W. H. Fell, 1955 Azcarraga, Manila.
Gelding, any age—
First prize.—W. H. Fell, 1955 Azcarraga, Manila.
Second prize.—W. H. Fell, 1955 Azcarraga, Manila.
CLASS E.—Foreign-native cross:
Stallions 3 years or over—
First prize.—Bartolome Katigbak, Lipa, Batangas,
Second prize.—Julian Katigbak, Lipa, Batangas.
Stallions 1 to 3 years—
First prize.—Oscar Hunt, San Lazaro, Manila.
Second prize.—Moises Dimandaal, Batangas, Batangas.
Mares 3 years or over—
First prize.—Mariano Syyap, 21 Escolta, Manila.
CLASS F.—Native:
Stallions 3 years or over—
First prize.—A. Muhlach, 1937 Felix Huertas, Manila.
Second prize.—Delfin Africa, Lipa, Batangas.
Stallions 1 to 3 years—
First prize.—A. Muhlach, 1937 Felix Huertas, Manila.
Second prize.—Norberto Mayo, Lipa, Batangas.
Mares 3 years or over—
First prize.—Miguel Lorzano, Lipa, Batangas.
CLASS G.—Ponies under 12 hands:
Stallions, mares, and geldings—
First prize.—John Giloy, 405 Real, Pasay.
Second prize.—Alberto Sisi, 960 Real, Malate.
CLASS H.—Native race horses:
First prize.—S. Reyes, c/o Manila Jockey Club.
Second prize.—A. Muhlach, 1937 Felix Huertas, Manila.
CLASS I.—Native light driving harness:
First prize.—Jose Lopez, Balayan, Batangas.
CLASS J.—Imported ponies under 12 hands:
Second prize.—Mrs. J. R. Wilson, San Juan del Monte.

CATTLE.

CLASS A.—Beef type:
Females 2 years or over—
First prize.—W. H. Fell, 1955 Azcarraga, Manila.
Second prize.—W. H. Fell, 1955 Azcarraga, Manila.
CLASS B.—Dairy type:
Bulls 2 years or over—
First prize.—Protección de la Infancia, 423 San Pedro, Manila.
Females 2 years or over—
First prize.—Protección de la Infancia, 423 San Pedro, Manila.
Second prize.—Protección de la Infancia, 423 San Pedro, Manila.

CLASS C.—Foreign draft type:
Bullocks 2 years or over—
First prize.—E. Evangelista, 808 Clavel, Binondo.
CLASS D.—Native draft type:
Bulls 2 years or over—
First prize.—Elias Hernandez, Bambang, Nueva Vizcaya.
Bullocks 2 years or over—
First prize.—Simplicio Araujo, Bambang, Nueva Vizcaya.
CLASS E.—Foreign-native cross:
Bulls 2 years or over—
First prize.—Genaro Evaristo, Dupax, Nueva Vizcaya.
Bulls under 2 years—
First prize.—Bonifacio Castro, Dupax, Nueva Vizcaya.
Females under 2 years—
First prize.—Genaro Evaristo, Dupax, Nueva Vizcaya.
Second prize.—Genaro Evaristo, Dupax, Nueva Vizcaya.

CARABAOS.

CLASS A.—Draft type:
Bulls 2 years or over—
First prize.—Martiniano Baluguing, Bambang, Nueva Vizcaya.
Second prize.—Mariano Molo, Pasay, Rizal.
Males (castrated) 2 years or over—
First prize.—Elias Hernandez, Bambang, Nueva Vizcaya.
Second prize.—Martiniano Baluguing, Bambang, Nueva Vizcaya.
Females 2 years or over—
First prize.—Mariano Molo, Pasay, Rizal.
Second prize.—Mariano Molo, Pasay, Rizal.

SWINE.

CLASS A.—Foreign type:
Males 1 year or over—
First prize.—J. R. Kuykendall, c/o Bureau of Public Works.
Second prize.—E. Wickham, 1285 Santa Mesa, Manila.
Males under 1 year—
First prize.—J. R. Kuykendall, c/o Bureau of Public Works.
Second prize.—E. Wickham, 1285 Santa Mesa, Manila.
Females 1 year or over—
First prize.—E. Wickham, 1285 Santa Mesa, Manila.
Second prize.—F. Gonzalez, 555 Misericordia, Manila.
Females under 1 year—
First prize.—J. R. Kuykendall, c/o Bureau of Public Works.
Second prize.—E. Wickham, 1285 Santa Mesa, Manila.
Females with litter—
First prize.—E. Wickham, 1285 Santa Mesa, Manila.
CLASS B.—Foreign-native cross:
Males 1 year or over—
First prize.—Genaro Evaristo, Dupax, Nueva Vizcaya.
Second prize.—G. C. Sellner, 2913 Herran, Manila.
Males under 1 year—
First prize.—Wm. S. Flavin, Our House, Cavite.
Second prize.—M. Lumbao, Calatagan, Virac, Catanduanes.

CLASS B—Foreign-native cross—Continued.
Females 1 year or over—
First prize.—Robert Ware, 35 Fernando Street, Pasay.
Second prize.—Rita L. Valdes, 964 San Sebastian, Manila.
Females under 1 year—
First prize.—M. Lumbao, Calatagan, Virac, Catanduanes.
CLASS C.—Native:
Females with litter—
First prize.—Co Dongoo, Pandacan, Manila.

GOATS.

CLASS B.—Foreign-native cross:
Males 1 year or over—
First prize.—María Villanueva, 17 Loma.
Castrated males any age—
First prize.—Mrs. J. R. Wilson, San Juan del Monte.

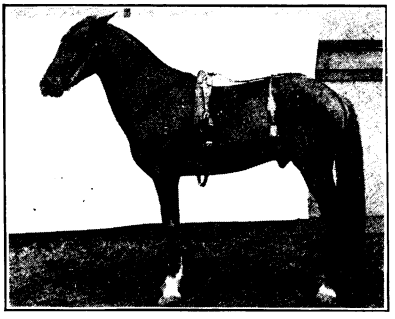
SHEEP.

CLASS A.—Foreign type:
Males 1 year or over—
First prize.—W. H. Fell, 1955 Azcarraga, Manila.
Second prize.—W. H. Fell, 1955 Azcarraga, Manila.
Males under 1 year—
First prize.—W. H. Fell, 1955 Azcarraga, Manila.
Second prize.—W. H. Fell, 1955 Azcarraga, Manila.
Females 1 year or over—
First prize.—W. H. Fell, 1955 Azcarraga, Manila.
Second prize.—W. H. Fell, 1955 Azcarraga, Manila.
Females under 1 year—
First prize.—W. H. Fell, 1955 Azcarraga, Manila.
Second prize.—W. H. Fell, 1955 Azcarraga, Manila.

POULTRY.

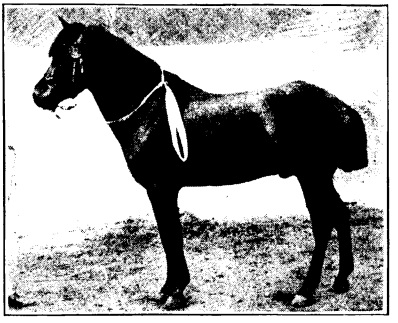
Best general exhibit:
First prize.—B. Fernandez, 881 Isaac Peral, Manila. (Special cup awarded by American Hardware Company.)
Second prize.—J. Ishikawa, 122 Solis, Tondo.
Best provincial display:
First prize.—Elias H. Gomba, Lipa, Batangas.
Second prize.—Carlos Young, Muntinlupa, Rizal.
Third prize.—P. Tanchanco, Ilagan, Isabela.
Native chickens (pairs):
First prize.—P. Tanchanco, Ilagan, Isabela.
Second prize.—P. Tanchanco, Ilagan, Isabela.
Foreign-native crosses (cock):
First prize.—J. Ishikawa, 122 Solis, Tondo.
Second prize.—H. A. Alexander, 612 Remedios, Manila.
Pairs:
First prize.—W. J. Ellis, 1613 Donada, Manila.
Second prize.—B. Fernandez, 881 Isaac Peral, Manila.
Bantam hens:
First prize.—J. Ishikawa, 122 Solis, Tondo.
Second prize.—R. King, 1128 Leveriza, Malate.

Bantam cocks:
First prize.—J. Ishikawa, 122 Solis, Tondo.
Light Brahmas (Trio):
First prize.—R. E. McGrath, 521 Peña Francia, Manila.
Single hens:
First prize.—R. King, 1128 Leveriza, Malate.
Second prize.—O. de Marcaida, 62 Alejandro Sexto, Sampaloc.
Third prize.—O. de Marcaida, 62 Alejandro Sexto, Sampaloc.
Cockerels:
First prize.—L. C. de Luna, 745 Leveriza, Malate.
Chinese Cantonese:
First prize.—E. F. Cheney, c/o Land Transportation Corral.
Second prize.—H. A. Alexander, 612 Remedios, Manila.
Cockerels and pullets:
First prize.—C. J. Nagal.
Black Minorcas:
First prize.—B. Fernandez, 881 Isaac Peral, Manila.
Andalusians (hen):
First prize.—B. Fernandez, 881 Isaac Peral, Manila.
Andalusians (cock):
First prize.—J. Ishikawa, 122 Solis, Tondo.
Orientals:
First prize.—B. Fernandez, 881 Isaac Peral, Manila.
Foreign crosses:
First prize.—J. Breckwell, Polo Club Stables, Pasay.
Second prize.—John May, 2326 Anloague, Manila.
White Leghorns:
Pens, 1 cock, 3 hens—
First prize.—R. E. Burris, Pandacan Quarantine Station.
Second prize.—Carlos Young, Muntinlupa, Rizal.
Third prize.—Mrs. S. H. Burris, c/o Pandacan Quarantine Station.
Trios, 1 cock, 2 hens—
First prize.—B. Fernandez, 881 Isaac Peral, Manila.
Second prize.—R. E. Burris, Pandacan Quarantine Station.
Third prize.—L. C. de Luna, 745 Leveriza, Malate.
Singles—
First prize.—E. H. Gomba, Lipa, Batangas.
Second prize.—E. H. Gomba, Lipa, Batangas.
Indian game (cocks):
First prize.—Carlos Young, Muntinlupa, Rizal.
Java game (cocks):
First prize.—B. Fernandez, 881 Isaac Peral, Manila.
White Orpingtons (hen):
First prize.—E. H. Gomba, Lipa, Batangas.
Second prize.—E. H. Gomba, Lipa, Batangas.
Buff Orpingtons:
Pairs—
First prize.—B. Fernandez, 881 Isaac Peral, Manila.
Trios—
First prize.—Carlos Young, Muntinlupa, Rizal.



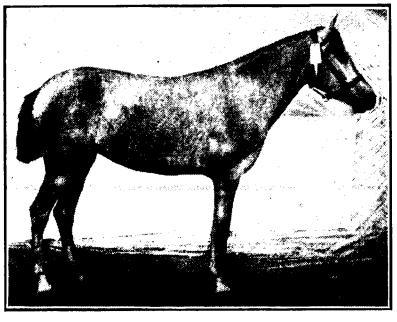
(*a*) Native-American stallion.

Owner, Joseph Dorell, Zamboanga, Mindanao. First prize, Class B, light-harness stallions; second prize, Class D, general-purpose stallions.



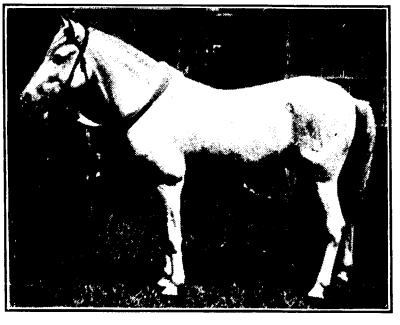
(*b*) Native stallion, 4 years old.

Owner, Delfin Africa, Lipa, Batangas. Second prize, Class F, native stallions, 3 years or over.



(*c*) Native Australian mestiza mare, 4 years old.

Owner, Mariano Syyap. First prize, Class E, foreign-native cross mares.



(*d*) Native stallion.

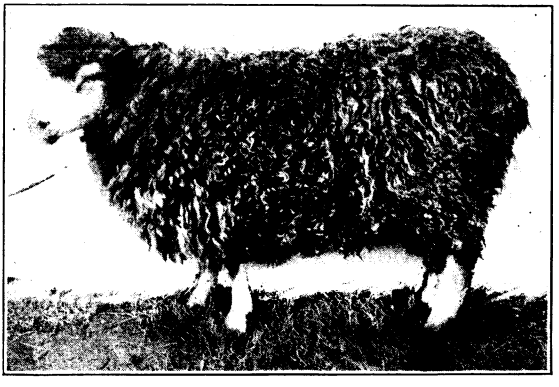
Owner, Alejandro Mulach. First prize, Class F, native stallions, 3 years or over.

(*a*) Galloway-native bull, 3 years old.

Owner, Genaro Evaristo, Nueva Vizcaya. First prize, Class F, foreign-native cross bulls.

(*b*) Indian-native carabao.

Owner, Mariano Molo. First prize, draft type, female.



(*c*) Lincoln ram.

Owner, W. H. Fell. First prize, imported rams.

Buff Cochin (trio):
First prize.—Paz Poatu, 714 Salcedo, Santa Cruz, Manila.
Display young Barred Plymouth Rocks:
First prize.—E. H. Gomba, Lipa, Batangas.
Display young White Leghorns:
First prize.—R. E. Burris, Pandacan Quarantine Station.
Second prize.—L. C. de Luna, 745 Leveriza, Malate.
Buff Plymouth Rocks (trio):
First prize.—E. H. Gomba, Lipa, Batangas.
Barred Plymouth Rocks (hens):
First prize.—J. Ishikawa, 122 Solis, Tondo.
Second prize.—Mrs. A. J. Neal, 1542 Real, Malate.
Third prize.—B. Fernandez, 881 Isaac Peral, Manila.
Barred Plymouth Rocks (cocks):
First prize.—J. Ishikawa, 122 Solis, Tondo.
Second prize.—Mrs. A. J. Neal, 1542 Real, Malate.
Barred Plymouth Rocks (cockerels):
First prize.—Mrs. A. J. Neal, 1542 Real, Malate.
Barred Plymouth Rocks (pullets):
First prize.—Mrs. A. J. Neal, 1542 Real, Malate.
Barred Plymouth Rocks (trio):
First prize.—J. Ishikawa, 122 Solis, Tondo.
Second prize.—Carlos Young, Muntinlupa, Rizal.
Barred Plymouth Rocks (pen):
First prize.—J. Ishikawa, 122 Solis, Tondo, Manila.
Second prize.—B. Fernandez, 881 Isaac Peral, Manila.
Barred Plymouth Rocks (pairs):
First prize.—Mrs. A. J. Neal, 1542 Real Malate.
Geese (Native):
First prize.—B. Fernandez, 881 Isaac Peral, Manila.
Geese (Chinese):
First prize.—L. C. de Luna, 745 Leveriza, Malate.
Ducks (mountain):
First prize.—B. Fernandez, 881 Isaac Peral, Manila.
Ducks (Muscovy):
First prize.—Mrs. A. J. Neal, 1542 Real, Malate.
Turkeys (native):
First prize.—L. C. de Luna, 745 Leveriza, Malate.
Second prize.—Robert Ware, 35 Fernando, Pasay.
Pigeons:
First prize.—Ricardo Summers, 793 Santa Mesa.
Peacocks:
First prize.—Rita L. de Valdez, 964 San Sebastian.

BUREAU EXHIBITS

THE BUREAU OF SCIENCE EXHIBIT AT THE 1914 PHILIPPINE EXPOSITION.

Prepared under the direction of ALVIN J. COX, *Director, Bureau of Science.*

It is very difficult to properly represent the various activities of the Bureau of Science at the Exposition for the reason that much of the work is of such a nature that it does not lend itself to exposition purposes. Chief among the exhibits of the Bureau of Science were those of calcareous and siliceous materials, nipa and nipa products, and mining products and processes.

LIQUID AIR.

A 19-horsepower liquid-air machine capable of producing 3 liters of liquid air per hour, consisting of a 200-atmosphere, 3-step, vertical-model compressor with a suction capacity of 54 cubic meters per minute and an Olszevski apparatus for the liquefaction of air, which at present forms a part of the well-equipped laboratories of the Bureau of Science, was exhibited. Liquid air is of great commercial value even though its practical applications are still largely undeveloped. No attempt was made at the Exposition to show the practical uses or commercial applications of liquid air. The demonstration included merely a few of the most interesting and spectacular experiments.

PHYSICAL TESTS OF ROAD METALS.

The Bureau of Science had planned to show the apparatus and demonstrate the methods used in testing materials of construction and supplies such as Portland cement, concrete, sand, gravel, road metals, iron and steel, tiles, pipes, bricks, rope, wire, paints, cloth, string, paper, roofing felts, galvanized iron, tin, asphalts, tars, bitumens, etc. However, owing to the fire, the space required to do this was given up for provincial exhibits and it was possible to show only the machinery and methods for testing road metals. This apparatus is a duplication of that used by the United States Government at Washington, and stones and gravel are tested for hardness, toughness, and abrasive and cementive properties. The hardness is indicative of the resistance which the stone offers to the displacement of its

particles by friction; the toughness to the pounding of the iron-shod hoofs of horses; the abrasion, to natural wear by the action of wheels, etc.; and the cementation is the ability of the worn-off stone to set and become an integral part of the road instead of being blown away as dust or washed away by rains, and to act as a binder for the larger material. Strange to say a stone may give excellent results under heavy city traffic and yet fail for country roads where the traffic is comparatively light. These tests enable the engineer to select the best material available and to judge beforehand its suitability for the road which is to be constructed.

WEIGHTS AND MEASURES.

Before the American occupation and previous to the passage of Act 1519 there was little uniformity in the weights and measures used in the Philippine Islands. Different standards were in vogue in different localities, fraud was not uncommon and the resulting confusion was very great. The metric system was adopted by legislative action in 1906. At the Exposition were shown the standards used at present throughout the Philippines, some of the Bureau of Science apparatus used in testing such standards, and some of the old Spanish units. Of special interest was the collection of weights and measures (each piece standardized at the Bureau of Science) furnished to each municipality. All the weights and measures used as municipal standards must first be compared with the standards preserved in the Bureau of Science.

CALCAREOUS AND SILICEOUS INDUSTRIES.

This was an impressive display which tended to create a just appreciation of the great industrial importance of such common and familiar mineral resources as sand, limestone, and clay. The work of the Bureau of Science has shown that limestones of excellent quality are abundant and of widespread occurrence throughout the Philippine Islands, and that in certain localities there is an abundance of sand, shale, volcanic tuff or clay, the physical and chemical properties of which guarantee to this Archipelago profitable and stable industries of great importance. The Bureau of Science exhibit showed the suitability of some of these available resources for the manufacture of Portland, Roman or natural, and hydraulic cements; lime; hydraulic and slaked limes; sand-lime brick and artificial-stone products, building, ornamental, and fire bricks, and vitrified bricks for paving streets; glass; tiles for roofing, paving, or ornamental purposes;

vitrified pipes, etc. Also, this exhibit brought forth many valuable lessons related to the conservation and utilization of natural resources and the commercial value of properly applied scientific industrial research work. Take for instance the subject of Portland cement. An inspection of certain raw materials from which it was purposed to manufacture cement showed that the limestone was very hard and tough. It must be reduced to a fine powder, and the excessive grinding expenses would be close to the maximum for the industry. That most desirable raw materials are available was made apparent by a group of large specimens which showed the soft coralliferous limestones and the easily pulverized siliceous materials available in a good locality and the excellent cement and concrete which they are capable of producing. This cement passed all the requirements of the Government's standard specifications and developed 80 per cent greater strength. These facts are substantiated by the polish, hardness, and general appearance of the concrete columns which were shown and labeled "The first concrete made from Portland cement manufactured from Philippine raw materials." A still more suitable calcareous material was represented by a sample of extremely fine sand from Palawan which requires practically no grinding. The Bureau of Science is investigating the possibilities of utilizing this sand and adjacent clays for the manufacture of Roman, or natural cement.

It is the opinion of the Bureau of Science that the present and near-future industrial and economic conditions of the Philippine Islands might favor the local manufacture of Roman, or natural, rather than Portland cement. Although natural cement hardens the more slowly, eventually it becomes the stronger and the fact that 10 million barrels were manufactured in the United States during one year proves its suitability for many kinds of concrete construction work. Natural cement requires a temperature of only about 1,000°C. for proper burning and the soft clinker is easily pulverized, whereas Portland cement requires a temperature of about 1,500°C. and the clinker is vitrified and stone-like in hardness. The exhibit included several dense, hard, concrete paving stones made from natural cement manufactured from Philippine raw materials by an "artificial" process which is advocated to produce a more reliable product than that manufactured in the United States, and it is hoped that the clay at Palawan will prove suitable for mixing with the fine calcareous sand for this purpose.

The significance of the two samples of Japanese and Philippine volcanic ash which were exhibited among the cements is also

worthy of comment. Volcanic ash is the sole raw material of a large and prosperous industry in Japan. It is used to mix with Portland cement to render concrete exposed to sea water less subject to disintegration. Although comparative tests conducted by the Bureau of Science indicate that the vast deposits of volcanic ash at Malabang, Mindanao, is superior to the commercial product from Japan, none of it has been used by the local Government.

The center of this exhibit showed the suitability of Philippine limestones for the manufacture of lime and lime products. Lime is an important factor in many commercial industries. The United States alone has 1,018 plants which produced 3,529,462 tons of lime in 1912. Although limestone of excellent quality is abundant throughout these Islands still the production of lime is small. The product does not meet the demand in either quantity or quality due largely to ignorance concerning the usefulness of good lime and the poor quality of the product burned in the crude local kilns. The Bureau of Science has constructed its own lime-kiln in order to obtain sufficiently good lime to carry on work in connection with the sugar industry. Lime from Philippine limestone manufactured in this kiln has a market value of ₱50 per ton on account of its great superiority over the ordinary local product.

The exhibit showed the limestones from Binangonan and the Montalban soft coralline limestones, which are similar to those which occur in many parts of the Islands, and various products derived from them such as lime, slaked lime, sand-lime brick, milk of lime for the sugar industry, fertilizer, fungicides, cement mixtures, etc. Attention is called to the fact that the lime industry probably would thrive best if conducted in connection with a sugar central or with a sand-lime brick plant and here again the significance of proper selection is made apparent. Thus, although Montalban limestone is capable of producing a lime of about 98 per cent purity, the soft coralline limestones require only about half as much fuel to produce a product which is very suitable for most industrial purposes.

Conditions in the Philippines are very favorable for the commercial manufacture of brick, building blocks, tiles, slabs, marbles, and ornamental stones from sand and lime, and the exhibit contained a fine collection of regular-sized sand-lime bricks made from Philippine raw materials which are available in the vicinity of Manila, Cebu, and Baguio. The cost of manufacturing and selling 9-inch (22-centimeter) bricks of the best quality is estimated at not to exceed ₱13 per 1,000 and attention is invited

to the fact that while over 300 sand-lime brick factories are in constant operation in Germany alone the industry has not been established in the Philippines. The question of proper selection has been given due consideration and the economic process of facing the cheapest brick with more efficient and pleasing surface mixtures is demonstrated. A very thorough study of the suitability of certain local sands, tuffs, and basaltic and andesitic quarry débris for the manufacture of sand-lime products has been published in the Philippine Journal of Science.

On the right the exhibit displayed an assortment of common, ornamental, vitrified, and fire bricks manufactured from Philippine clays which will compare favorably with the best similar products of commerce. This exhibit was especially significant when we consider that the only commercial brick manufactured locally is a poor grade of common brick. There were dense fire bricks, as strong and refractory as the famous products of the Denver Fire Clay Company, which were manufactured from clay from Calamba, and yet 1,556,000 furnace bricks having a market value of over ₱100,000 had to be imported to meet the local demand during the fiscal year 1913, because no fire bricks are manufactured in the Islands. In fact the excellent Calamba fire and pottery clay is being depleted for the purpose of making cold-water paint for whitewashing purposes, whereas it should be reserved for ceramics and slaked lime used for the paint.

Again no vitrified bricks or clay products such as pipes, drains, tiles, face and paving bricks, etc., are manufactured locally, yet this exhibit showed very clearly that the raw products for all these things are to be found here. Vitrified products such as bricks for paving both country and city roads, pipes for drains and sewers, and tiles for floors and roofs need not be imported nor dispensed with. Several of the bricks shown had a very pleasing appearance, and the clay mixtures used for their production should prove very valuable for ornamental tiles, brick, and pottery. However, it should be borne in mind that the Bureau of Science has made no attempt to produce fancy or decorative articles. Its efforts are devoted to a study of the physical and chemical properties of the raw materials and there has been opportunity and time to study only a few of the available ceramic resources. As a matter of fact few clays prove satisfactory in themselves for commercial purposes, and the best results are usually obtained by blending several clays or mixing one or more clays with a suitable quantity of sand, feldspar, silica, sawdust, coal, pigment, etc., according to the product desired.

The clay exhibit also contained an experimental brick machine, which was a miniature reproduction of the commercial article manufactured by Chambers Brothers Company, of Philadelphia, and a very valuable acquisition to the clay-testing apparatus of the Government as it subjects the raw materials to actual working conditions.

The advisability of studying the characteristics of a clay before purchasing machinery to work it, was made apparent by two groups of bricks manufactured from Palawan clay which are used at the penal colony. The brick produced by the stiff-mud process at the Bureau of Science was hard and dense, whereas that produced by the soft-mud process was extremely porous and unpleasing in appearance.

A model showing the manufacture of salt by the Chinese and Filipino methods was displayed in front of the Bureau of Science building on the Bagumbayan side.

ORGANIC CHEMISTRY EXHIBIT.

This exhibit was designed with two objects in view: First, to show manufactured products from Philippine raw materials; and second, to include a food exhibit as an educational feature.

First, there were thirteen samples of papers, dried paper pulp, and wet paper pulp, manufactured from the following list of substances:

Cogon
Talahib
Lauan (white)
Cupang
Mayapis (palosapis)
Teluto
Talisay
Nipa (stalk)
Waste hemp
Rice straw
Dwarf bamboo
Dwarf bamboo (unbleached)
Structural bamboo

It was shown that many Philippine raw materials can be made into good paper pulps. Several materials, which have never been employed before in the manufacture of paper, were here utilized; for example, the nipa palm.

Waste woods were utilized by destructive distillation, producing various grades of charcoal and distillation products of value, such as wood preservatives and the manufacture of a long list of different chemical substances.

A list of the woods so far employed is as follows:

Bacauan
Tanguili (sawdust)
Apitong
Palosapis (mayapis)
Lauan (white)
Guijo
Narra
Ipil
Yacal
Tanguili (tanguile)
Api api
Benguet pine
Coconut shells

The charcoals exhibited were of excellent quality and, in some cases, equal to the best charcoal made in other parts of the world. Coconut charcoal, having superior qualities for very exacting laboratory uses, was exhibited. The work of the examination of the distillates for acetic acid, methyl alcohol, guaiacol, creosotes, and many other substances is in progress, and an exhaustive investigation will probably require a year's time.

The nipa palm is one of the most valuable plants growing in the Philippine Islands. Over 100 different products from this palm were exhibited. Several of the products exhibited were new and have been developed in the Bureau of Science laboratories, such, for example, as the industry of making sugar from the sap of the palm, the manufacture of paper from the fibers, and the manufacture of beverages of the nature of brandy and called "nipa-palm brandy."

A large number of Philippine vegetable oils were shown. Some of these oils are well known commercially, and others are capable of commercial application. Several new oils, unknown to scientists, are now in the process of investigation.

Second. The exhibit of the food laboratory consisted of a graphic representation of:

A. The substances which make up the human body.

B. Well-balanced rations for Filipino laborers.

It is well known that the majority of the people of the Philippine Islands do not enjoy well-balanced rations, a fact which is productive of various diseases; for example, beriberi. These rations are designed to be such as can be easily and inexpensively obtained by the average Filipino.

C. This was an exhibit of dyes used in foods, of dyed foods, and of the quantity of dyes which can be obtained from various food substances and fixed upon cloth. These cloths formed a striking example of the amount of chemical dyes taken into the system when artificially colored foods are employed.

D. This was an exhibit of thirty-two manufactured products obtained from maize. All of these products have various commercial uses and are produced in large quantities.

This portion of the exhibit formed a striking example of the work of the chemists in separating and developing different products from raw materials.

E. An exhibit of the various varieties of milk imported into the Philippine Islands and a chart showing the nutritive value of each variety. It is well known that the majority of the infants born in the Philippine Islands are not properly nourished, and that the mothers are not capable, either for a lack of sufficient

food or for other reasons, of properly nourishing a child. It, therefore, becomes imperative that good infant foods be available. There is much abuse of the various grades of milk in the matter of infant feeding because some imported milks give rations which are so improperly balanced that an infant cannot be properly nourished by their employment. Moreover, the composition of certain milks is such that they cannot be modified to make suitable food for infants. The best classes were shown upon a chart, together with a comparison with others which should not be employed in infant feeding.

It was realized that an exhibit of chemicals and laboratory substances is usually of little interest to the layman. However, the attempt was made, by means of charts and graphic illustrations, to arrange an exhibit which would be instructive to all.

MINING EXHIBIT.

The mining exhibit consisted two parts, private and Government. The private exhibits were as follows:

Near the north entrance to the Bureau of Science exhibits was a model of Camiguin Volcano with sulphur deposits on the slopes. This exhibit was furnished by the Camiguin North Mining Company, Captain Fred Burdette, manager. The model was very attractive as well as realistic owing to the use of red lights on the inside. The next individual exhibit consisted of gold specimens from Ambos Camarines, exhibited by Messrs. Ingersoll and McDonald. These exhibits contained very fine specimens of visible gold from the placers of the Paracale district. The next individual exhibit was that furnished by D. M. Carman, president of the Cansuran Mining Company. This collection contained some very fine gold nuggets. This exhibit was followed by specimens loaned by Mr. Cassanovas from the Tumbaga mine, Ambos Camarines. The last individual exhibit consisted of some very good-grade asbestos from Ilocos Norte, furnished by Doctor Gross.

The Government exhibit consisted of a very large and excellent relief map of the Philippine Islands made in the Bureau of Science. There was also a collection of facsimile gold bars representing the annual production of gold in the Philippine Islands. This exhibit illustrated graphically the remarkable increase in gold production in the last two years. Near this exhibit was a shelf full of relief maps of individual mining districts. One of these was a new relief map of the oil field of Tayabas, made in sections and colored to show the geological formations. Inside

the central space devoted to mining exhibits and near the entrance there was first to be found a revolving rack containing over one hundred photographs of mining and geological subjects. A special feature of this collection was the group of pictures of numerous well-known mining men who have done the most to promote the industry in the last fifteen years. Next to this came a model of a California oil-well rig, showing the relation of the well site to the geological structure. Then there was a very interesting model of a gold dredge very similar to the Gumaus dredge in Ambos Camarines. This model, complete in detail, was connected to batteries so that it could be made to operate. It was a complete gold dredge in miniature. Next to this came a very realistic model of a hydraulic mining plant, very similar to the one now being installed on the Cansuran property in Surigao, Mindanao. A very interesting model of a modern sugar mill showing the processes involved and the path of the juice from the sap to the finished product was on display. All of these models were made by trade-school boys under the direct supervision of the geologists. At the extreme southeast end of the mining exhibit was a large hexagonal case containing mineral specimens from various parts of the Archipelago, copper, lead, gold, etc. In addition to these models and cases there were exhibited about a dozen large geological maps and pictures arranged and prepared so as to show various geological and mineralogical data. Lack of space prevented the Bureau of Science from making a larger exhibit which would have included samples of coal, iron, fossil shells and plants, etc. These exhibits and models together with many others are now on display in the mining and geological museum of the Bureau of Science, and may be seen at any time during office hours.

BOTANY.

As a matter of some general interest the actual method of mounting botanical specimens was shown, illustrating some of the processes by which dried material is prepared for permanent preservation and study. All the botanical material belonging to the Bureau of Science is so prepared, and becomes a part of the permanent records of the Bureau. The typical unit herbarium case was also shown, and the method of arranging the mounted material for ready reference. The herbarium is in reality an enormous card catalogue of the scientific and economic phases of the Philippine vegetation, the mounted specimens corresponding to index cards.

A station for physiological and ecological observations was also

shown, representing a reproduction of a bit of mountain forest with the instruments used to measure environmental conditions. The environmental factors are intimately related to the growth of and the physical type of the vegetation, involving temperature, rainfall, and its seasonal distribution, humidity, wind, temperature, soil moisture, soil temperature, etc. A practical application of the work is in the determination of how much a forest can be exploited without permanent injury or entire destruction; that is, how valuable types of forests can be conserved, and inferior types improved. In actual forest work in the Tropics comparatively little is known as to what percentage of trees can safely be removed from a given forest without serious injury to such forest. In this part of the exhibit the trees used are bizarre ones, selected on account of their curious appearance, the canopy being formed of epiphytic orchids and large ferns. The forest floor consisted of typical forest plants, erect and climbing palms, ferns, and small trees. The instruments shown were only about one-third of those actually used in the forest, and consisted of a recording thermometer, a recording hygrometer, a wind gauge, a rain gauge, an evaporimeter, and a radioatmometer used in measuring light. The instruments used give a complete record of conditions encountered at the observation stations.

SILK EXHIBIT.

Several years ago friends and employees of the Bureau of Science imported silkworm eggs from Japan as well as Ceylon. The Bureau of Science has since demonstrated that the Bengal-Ceylon hybrid and Philippine races of silkworms yield an excellent quality of silk and produce a generation of worms every forty-five days. Racks supporting trays of silkworms in the different stages of their existence together with the baskets of mature cocoons formed a part of this exhibit. Other portions of the exhibit had to do with all phases of spinning and reeling of silk on the hand reel such as is used by the Japanese in their home silk industry. Filipino women were there to demonstrate the spinning, reeling, and weaving.

ORNITHOLOGY.

Several cases of mounted Philippine birds were on display.

ETHNOLOGY.

Centrally located cases from the museum on Calle Juan Luna showed a representative collection of weapons from all parts of

the Islands and coats of armor manufactured by the Moros, probably after patterns taken from the Spaniards. An exhibit of commercial rubber in this part of the building was of considerable interest. Under the present Director, the museum on Calle Juan Luna has been remodeled and rearranged and the exhibits there are well worth visiting.

FISHERIES.

A museum case showing a very interesting display of the commercial fishery products was exhibited and on the wall behind it were mounted specimens of large game fish caught in waters south of Manila. The outfits used in this work were also displayed. A model fish pond stocked with mosquito-eating fish attracted no little attention and a pond equipped with a model fish trap showed the way in which a large portion of the fish food supply of the Islands is secured.

Much more elaborate plans were originally made for the Bureau of Science exhibit at the 1914 Exposition but owing to the unfortunate occurence which resulted in the destruction of the buildings to be used for provincial exhibits it was found best to allot almost a half of the Bureau of Science building for provincial exhibits. This necessitated the omission of several parts of the exhibit upon which considerable time and thought had been spent. Taking all this into consideration the exhibit as concentrated and rearranged was by far the most elaborate effort of the kind ever made by the Bureau. The interest and approval of the public as evidenced by the great crowds which filled the building from the opening to the closing hours was a most gratifying result for the time and labor so enthusiastically given by every member of the staff of the Bureau of Science in the preparation of the exhibit.

BUREAU OF PUBLIC WORKS EXHIBIT.

Prepared under the direction of WARWICK GREENE, *Director of Public Works.*

The exhibit of the Bureau of Public Works occupied a separate building near the Calle Nozaleda end of the Exposition grounds. It was formally opened February 6, following the inspection of the Governor-General and the Speaker of the Assembly during the evening of the previous day. The floor space was 900 square meters, or nearly one-fourth of an acre. The exhibit remained open daily until the night of February 16.

The attendance was in excess of any previous public-works exhibit in the Islands, as is evident from the following figures:

	Total attendance.	Maximum daily attendance.
Philippine Exposition 1914	147,272	26,187
Philippine Carnival 1913	105,500	21,000
Iloilo Carnival 1913	26,940	5,800
Cebu Exposition 1913	17,767	5,232
Samar Exposition 1914	16,187	7,449
Leyte Carnival 1913	11,031	3,690

Only ₱3,500 was available for the exhibit and it was necessary to borrow exhibits from various sources. The Philippine Board of the Panama-Pacific International Exposition authorized the use of the thirty large transparencies prepared for exhibit in San Francisco. These photographic plates, measuring up to 5 feet (15 decimeters) in length and 2½ feet (7.6 decimeters) in width were specially prepared in Saint Louis, Missouri, but were exposed, developed, and colored by the Bureau in Manila. The views selected covered the more important classes of work performed by the Bureau, usually selected because of the surroundings which were typically Philippine. Each transparency was illuminated by four 50-candlepower lights placed behind the ground glass. This method of illumination, combined with careful use of color, did away almost entirely with the flatness characteristic of photographic work, and decidedly intensified the perspective.

The Capitol Committee loaned a large and recently completed model of the proposed development for an Insular Capitol in Manila. This model, made of wood, showed the central park area of Manila from the New Normal School to the Bay front and from Intramuros to the American Cathedral. The Rizal Monument, the Department buildings, the Library, and location for the other branches of the Government were carefully marked. The visitors, both official and otherwise, showed a marked interest in this model, the platform being surrounded during the entire evening by a throng three or four deep.

In addition to these two exhibits specially loaned to the Bureau the traveling public-works exhibit was shown. This consists of some 50 small transparencies and about 130 large views of various public works. This is so arranged that it can be landed from a vessel, transported to the place of exhibit, and set up within two hours. It has proved a drawing card in the four provinces it has visited to date.

These small transparencies illustrate the good and bad methods in building and utilizing public works. For example, a view of an old style fish stall on the ground is accompanied by a view of the new style elevated stall in a market, the fresh fish laying on a concrete slab. Similarly, old and new schools, provincial buildings, roads, and wells are compared, likewise ferries are shown alongside of the bridges which replaced them.

The large views of public works run to 2 meters in length. They show the most recent developments in actual construction and in final results. The scenery of the Philippines is so characteristic and picturesque that a large number of views of public works are interesting from an artistic standpoint. The views further serve to show the provincial people just what the other provinces are doing.

Both the small transparencies and the large views are periodically brought up to date, by replacing old photographs with new ones and by securing views of the latest developments.

GENERAL REVIEW OF THE 1914 INDUSTRIAL EXHIBITION OF THE BUREAU OF EDUCATION.

By LUTHER PARKER, *Manager.*

On the whole the 1914 exhibition was bigger, better, and more satisfactory in all ways than any former exhibition of school industrial work ever held under the direction of the Bureau of Education in the Philippines.

The fact that the field was able to put up a ₱100,000 exhibit of school work between the beginning of schools in June and the opening of the Exposition in the following January, a matter of a scant six months, speaks volumes for the organization of the work, its extension, and the efficiency of the teachers and pupils, and is a practical justification of the system difficult to gainsay.

It must also be borne in mind that the exhibit sent to Manila represented but a fraction of the work done in the schools. Only the very best was sent to the Insular exhibit and the local markets in each province absorbed the ordinary grades. One of the most significant facts observed in this exhibition was the success that attended the sales from those divisions where standardization had been most satisfactorily effected. Three provinces that merit special mention in this connection are Ilocos Norte, Zambales, and Albay. Instead of a heterogeneous lot of experimental work, a few lines of well-made articles were sent that made a pleasing exhibit and sold readily. Those divisions that showed no originality but attempted to

copy the work that was successful in other provinces last year, helped to demonstrate the fact that originality is rewarded. Some of the most successful lines of industrial work, commercially considered, have been developed in the field by enthusiastic teachers who had originality enough to branch out on new lines.

It seems fitting at this point to make a record of several of the most successful articles that owe their existence to the ingenuity of particular individuals, such as the "Polangui" type of basket originated by H. E. Cutler in Polangui, Albay; the "Zambales" basket which was developed by Juan Santos in Zambales from the Ilocano fishing basket; the "shamrock" workbasket which is the work of Gil Raval of Ilocos Norte; the spherical bamboo workbasket in the endless sauale weave developed under the direction of W. H. Champman of Pampanga; the covered air-root workbasket made by Vicente Concepcion of Tayabas; the various types of kilog baskets developed under the guidance of R. H. McLeod of Laguna; the rag doll of Camiling, Tarlac, perfected under the direction of Miss Norah M. Wise; the buri-raffia cushion covers and textiles adapted and originated by Jos. H. Loughram and R. R. Sage of Iloilo and Bohol, respectively; and several other articles of equal merit but not so long established and well known as those mentioned.

In a close study of the exhibition just passed, it will be seen that its success was in the main due to the predominance of the above-named standard lines which were made in large quantities in the provinces where they originated and were copied to some extent by those provinces that have been content to secure their models each year from the provinces that have originated something successful.

In the line of basketry there was a notable success this year for those divisions that gave attention to the reproduction and adaptation of purely native types in bamboo, rattan, nito, and pandan. Probably the most striking exhibit was that from Palawan where archaic types of decoration closely akin to Javanese forms are well known to the old basket makers. The next in point of interest were the many archaic types from the isolated barrios in Iloilo Province. The Mountain Province could profitably turn its attention in basketry and textiles to the development of native types, and an ingenious industrial supervisor of industrial work would work wonders in this division.

The success attending the production of native types of bas-

ketry this year will no doubt stimulate many teachers to utilize baskets that have hitherto received no consideration, having been passed over as unattractive or "common."

It is the belief of the writer that the Philippine Islands offer the best field in the world for the production of useful and artistic basketry in commercial quantities, and that this line of school work merits more than ordinary thought and attention.

The questions of the supply of raw materials available, number of workers, standards of workmanship and design, and correct prices should be given very serious consideration before introducing any line of industrial work in the schools of a division or municipality, since mistakes made in training workers are difficult to eradicate and bring discredit on those responsible.

During the coming year much attention should be given to the production of articles designed for use in the homes of the people. Furniture of bamboo and wood suitable for use in Filipino homes should be prepared and less attention should be bestowed on making such articles to supply the local demands of the foreign colony. Grades I, II, and III should be principally occupied in learning graded processes of handwork in various lines and in the production of simple, ordinary articles for home use. The production of articles for interprovincial and foreign trade should begin not lower than Grade III and culminate in Grade VII, and then be carried over into the homes of the people as home industries.

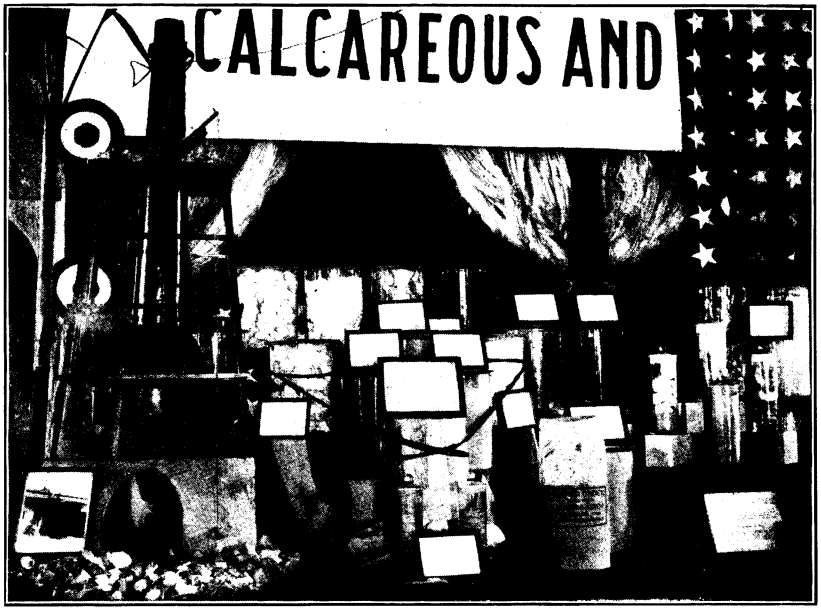
One of the most commendable forward steps noted this year in standardization of industrial work was the preparation of a catalogue by the division industrial supervisor of Samar covering all lines of industrial work carried on in the division. The effect of this standardization was very evident in the exhibit sent by Samar.

The exposition idea has taken hold in the provinces and has served to acquaint the people with the scope and character of the industrial work of the schools and to arouse enough interest and enthusiasm to augur a continuance of the work along present lines for many years.

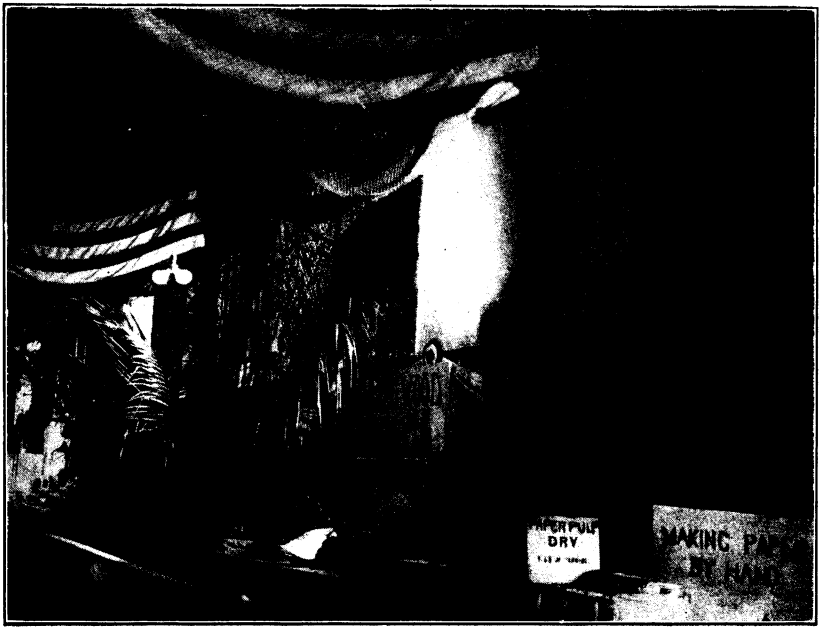
THE AGRICULTURAL EXHIBIT AND CORN DEMONSTRATION OF THE BUREAU OF EDUCATION AT THE 1914 PHILIPPINE EXPOSITION.

By NORTH H. FOREMAN, *Inspector of School Gardens and Sites, Bureau of Education.*

The display of agricultural products from the school and home gardens and farms of the Bureau of Education was a great surprise to those who are unfamiliar with the agricultural

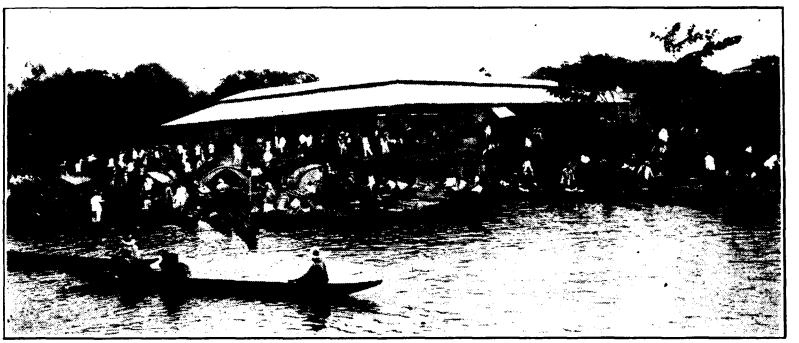


(*a*) Cement materials, cement, and cement products.



(*b*) Industrial products from Philippine raw materials.

(*a*) The new anicut dam constructed by the Bureau of Public Works for irrigation purposes in Tarlac Province.



(*b*) The recently completed municipal market at Hagonoy, Bulacan Province, built by the Bureau of Public Works.

Prize-winning corn shown in the Bureau of Education exhibit.

training given in the public schools. Even to those who are in close touch with the agricultural resources of the Philippines and with the work of the Bureau of Education it was a surprise. It showed a marked improvement over the past exhibits of the Bureau of Education. It was the fourth display, and the largest and best collection of garden and farm products ever assembled in one place in the Philippines, and was one of the many interesting educational features which formed the industrial and sales exhibit.

In making a study of the agricultural section, it should be borne in mind that the exhibit was planned with the intention of showing the advancement made in agricultural development through the medium of the public schools. The improved quality of the products and the extent to which food production is being extended into the home life of the people through the supervised home projects of school pupils could not be shown in a clearer manner. Production from school farms, and school and home gardens, as well as a comprehensive dry-seed exhibit and a corn demonstration were included. Each of these had special points of interest, some of which will be mentioned later in this article.

Garden products.—The individual excellence of the vegetables and the wide range of varieties were interesting features of the large display work upon which products representing the 2,300 school gardens and the 35,000 home gardens of school pupils were exhibited. An accurate compilation of records shows that 34 of the 37 provinces in the Philippines were represented and that, by actual count, 390 school gardens and 1,504 home gardens furnished products for this display. The excellent coöperation of 390 schools teachers and 1,500 active Filipino school boys made the exhibit a marked success.

Special booths.—The agricultural section was arranged to provide 11 special booths for display of products from the agricultural and farm schools of the Bureau of Education, representing 11 different provinces. These booths were filled with products grown on the model 10-hectare farms which are conducted as the central unit of the farm schools. Each school had one or more special features which might be described, but for the purpose of this article a general mention is sufficient. The excellent corn shown in the Indang Farm School booth attracted a great deal of attention, as the ears were the largest ever exhibited in the Philippines. The peppers and cabbages from the Batac Farm School and the legumes grown at the

Batangas Farm School deserve special mention. These schools also had on exhibit some excellent and well-prepared bales of forage which included corn-leaf fodder, Guinea grass, peanut vines, and pea vines.

Those who were interested in the details of agricultural education found the exhibit of the Central Luzon Agricultural School of special merit, as it showed in a very practical manner the system of management and the kind of work taught at the school. People have heard in an indirect way of the farm work being done by the Bureau of Education at the non-Christian settlements in the Province of Agusan, Mindanao. These schools were represented by a most creditable exhibit notwithstanding the great distance from Manila and the poor transportation facilities, which made it impossible to include more perishable products.

Nursery exhibit.—The Tanauan Intermediate School, for the third time, placed a representative exhibit of the nursery work done in the schools which afforded an excellent opportunity for a study of the nursery work of the Bureau. It included a wide variety of cuttings and seedlings, as well as a number of young budded trees.

Dry-seed exhibit.—As a special agricultural feature for this year, a comprehensive display of dry seeds was made. This was the most complete collection of seeds ever exhibited in the Philippines. It represented a wide area, as the seeds came from 156 municipalities representing 28 provinces. Many excellent varieties of legumes were shown. It was an instructive exhibit and attracted much attention. The booth was interesting to the thousands of people who visited it. It was ascertained by actual count that more than 300 people stopped at the booth during one hour.

Corn demonstration.—The various features of the campaign which the Bureau of Education has been carrying on to foster the production and use of corn were shown in a separate building, known as the "Corn Building." This building contained a practical demonstration of all features of the 1913 corn campaign. It included the final corn exhibit of corn-growing contest No. 2 of the 1913 corn campaign containing corn from every province in the Philippines except Isabela. The corn displayed showed an improvement of 60 per cent over the exhibit of last year.

As this was the final feature of corn-growing contest No. 2, the corn was scored by a committee composed of Mr. H. T.

Edwards, Assistant Director of Agriculture; Hon. Melecio Severino, chairman, Agricultural Committee, Philippine Assembly; and Mr. J. F. Boomer, formerly editor of the Cablenews-American. The exhibits were judged according to the score cards introduced into the Philippines by the Bureau of Education for use in the corn campaign. A compilation of the scores resulted in the designation of the following winners:

First, Pedro Cariño, age 13, Tubao, Union.

Second, Luis Platon, age 13, Tanauan, Batangas.

Third, Conrado Mendoza, age 20, Balanga, Bataan.

The winning exhibits were shown along with those winning similar places last year and showed a decided improvement both in the size and in the quality of the corn.

Special booths in the corn building were devoted to a display of corn implements, storing of corn, seed selection and seed testing, corn products, preparation of corn meal and the preparation of corn foods.

The corn-implement booth contained plows, harrows, planters, corn shellers, and corn mills. The booth attracted a great deal of attention, and numerous questions were asked of the demonstrators regarding prices and where the implements could be secured.

The storage of corn was demonstrated by a display of various native methods now employed in the Philippines and the use of the plant called "lagundi" for the preservation of corn, the properties of which were recently discovered by a teacher of the Bureau of Education. Corn was shown in the husk, on outdoor racks, on trees, and storage in many other manners.

The value of selecting a certain type of ear from stalks with desirable qualities, as well as the testing of seed corn before planting, were featured. Such simple methods of seed testing as the plate method, the box method, and rag-doll method were shown. Depth to plant and the value of fertilization were also shown by practical demonstration. Many Filipino farmers who visited the booth left with a better knowledge of how to test seed corn and how to apply this information in increasing their corn crops.

The actual preparation of corn meal by primitive methods and also with a modern handmill was shown in a separate booth. It was a very valuable demonstration of what can be done with the mills which are now available for every home, and were introduced by the Bureau of Education as a feature of the corn campaign.

An interesting and very instructive feature of the corn demonstration was the preparation and serving of corn foods by girl students from the Philippine Normal School. Such dishes as can be prepared with the simple utensils and ingredients common in Filipino homes were prepared in full view of the public, and the foods served to the people. This, along with the distribution of the recipes, forms a very instructive and interesting part of the corn demonstration work of the Bureau of Education.

In passing judgment upon the work, it must be clearly understood that no attempt was made to show the agricultural resources of the Philippines, as work of the Bureau of Education is concerned with the youth of the land and the exhibit was intended to demonstrate what is being done in the public schools of the Philippines. The larger agricultural propositions which deal with adults were left to other Government agencies. No agricultural products were displayed which were not produced by public-school pupils under the direct supervision of teachers. The exhibit showed latent resources of the Philippines, however, and indicated in a very definite manner the agricultural prosperity that the Philippines will enjoy when similar methods are employed on the farms throughout the Philippines.

COAST AND GEODETIC SURVEY.

By Capt. P. A. WELKER, *Director of Coast Surveys.*

The Coast and Geodetic Survey exhibit consisted of several representative Philippine charts; a detailed progress map showing graphically the amount of hydrography, topography, and principal triangulation accomplished since the organization of the Bureau in 1902; tabulated statistics giving a general idea in figures of the great amount of field work performed; and the first three maps of interior regions of the Islands compiled and published by the geographical division.

The charts shown were only 4 out of the 124 which have been published and issued by this service and which contain the results of topographic surveys covering an area of 13,427 square miles, and of hydrographic surveys covering an area of 81,775 square miles with 3,618,679 soundings. In connection with the great networks of triangulation, graphically represented, 39 stations were occupied for the determination of telegraphic longitude and primary latitude, 83 base lines were measured, and the geographic positions of 7,173 points were determined.

An examination of the progress map on exhibition showed

that 65.6 per cent of the work of charting the Islands has been completed, and when the fact is taken into consideration that the coast line of the Philippines is more than twice the length of the combined Atlantic and Pacific coasts of the United States, an estimate may be formed of the vast amount of work which has been accomplished.

The geographical maps of the interior regions deserve special mention as being the first of their kind to be published by the Philippine Government. These are the only reliable topographic maps of the areas shown and are noteworthy not only for the amount and for the accuracy of the information which they furnish but also for their excellent and artistic drawing and lithography in several colors. Three of these maps have already been published, a fourth is in the printer's hands, and others are in course of preparation.

THE INTERNAL-REVENUE EXHIBIT—TOBACCO AND DISTILLED SPIRITS.

By G. H. TILBURY and J. G. DE SOUZA, of the Bureau of Internal Revenue.

Visitors to the internal-revenue exhibit at the Second Philippine Exposition were doubtless surprised at the fine display of liquors made by Philippine distillers. Almost every known liquor was represented, and all were put up in as attractive a manner as any imported liquors.

The manufacturing distilleries are equipped with modern distilling and rectifying apparatus, and the quality of the products therefore depends entirely upon the class of materials used and the skill of the operators. Alcohol in the Philippines is distilled almost entirely from the sap of the nipa and coco palms. These trees yield a sap which is known locally by the name of "tuba." Tuba, when it first comes from the trees, is a pleasant, refreshing, and nonintoxicating drink. If allowed to stand for a short time it begins to ferment and, while still a pleasant beverage, is somewhat like beer and is slightly intoxicating if taken in large quantities. When fermentation is complete, the tuba is passed through a distilling apparatus and converted into alcohol, and by passing this through the rectifying machine rectified spirits equal in every respect to those produced in the United States and Europe are obtained.

It is generally known that rectified alcohol forms the base of compound liquors. Compound liquors are manufactured and consumed in large quantities in both the United States and Europe, and by importing the necessary ingredients, liquors equal to those imported may be produced in the Philippines.

Rectified alcohol used by the United States Army and Navy in the Philippines for medicinal purposes is of local manufacture.

Liquors of domestic manufacture have a great advantage over those imported in the matter of tax. Imported liquors pay ₱1.40 per proof liter in customs and internal-revenue taxes, whereas liquors of Philippine manufacture pay no customs duties and only 25 centavos internal-revenue tax per proof liter.

A very creditable exhibit of denatured alcohol was also made by local distillers. In addition to various kinds of alcohol lamps, a number of model engines and a launch were exhibited demonstrating that denatured alcohol may be used with almost every class of internal-combustion engine. The exhibitors claim that denatured alcohol can be used in automobiles as economically as gasoline, providing a few minor changes are made in the motor.

The tobacco exhibits were also very interesting and instructive. A splendid display was made by six of the leading manufacturers of Manila of the manufacture, packing and marketing of cigars and cigarettes and also of the leaf tobacco used in their manufacture.

Leaf tobacco is produced all over the Philippine Islands, but the Cagayan Valley, which produces by far the greater part of the tobacco grown, is especially noted for the quality of its leaf. Tobacco is grown on both sides of the Rio Grande beginning with Alcala, Cagayan, and extending to Echague, in the Province of Isabela, a stretch of land varying in width from a few to perhaps 10 miles. During the rainy season from September to December, the Cagayan River and its tributaries rise from 10 to 40 feet, covering the valleys for miles on either side with their muddy waters and leaving a deposit sometimes of several inches of silt thus richly and generously replenishing the land so that the growers who cultivate tobacco on those lands start off every season with everything in their favor.

The production of leaf tobacco in the Philippine Islands has increased from 24,009,227 kilos in the fiscal year ending June, 1910 (the first year official figures were published), to 30,431,004 kilos in the fiscal year ending June 30, 1913. Exports of leaf tobacco, including a very small percentage of smoking tobacco, as shown by the Bureau of Customs annual report for the fiscal year 1913, have increased from 6,059 metric tons in 1899, valued at ₱1,835,072, to 13,309 metric tons in 1913, valued at ₱4,079,452, the average value per ton increasing from ₱302.86 to ₱306.52. It is interesting to note that the 6,059 tons exported in 1899 represented 6.7 per cent of the total exports while the 13,309 tons in 1913 was only 3.8 per cent of the total

exports, which speaks well for the general prosperity of the Islands.

Great care is taken by the factories in the selection of the leaf tobacco used in the manufacture of cigars and cigarettes, and every effort made to turn out first-class articles. All cigars in the city of Manila are Filipino handmade which gives employment to many thousands of cigarmakers, both male and female. The cigar workers are arranged in classes for the preparation of the leaf, such as stripping, etc., which is always done by hand, cutting wrappers to uniform size, and stacking them ready for work. One section can be seen with piles of tobacco leaf in front of them rolling cigars, others putting on rings and tinfoil, packing in boxes and putting on labels, etc. A good cigarmaker of high-grade cigars can make from 100 to 150 per day, of low grade cigars from 150 to 300 per day, and an exceptionally good cigarmaker can make 350 cigars a day. Most of the factories limit the number of high-grade cigars to be made by each worker in a day in order that the greatest care may be taken in the workmanship.

The United States market has been of great benefit to the cigar industry of these Islands. A comparison of the annual average prices furnishes a striking illustration of the effect which the American market has had upon this industry:

	Per thousand.
1909	₱18.64
1910	30.32
1911	25.72
1912	30.34
1913	32.36

Exports have increased from 27,936,000 in 1911, valued at ₱1,435,814, to 101,647,000 in 1913 valued at ₱4,422,680.

The total production of cigars in the Philippine Islands has increased from 168,526,079 in 1906 to 305,651,429 in 1913, and the total exports to all countries from 167,991,000, valued at ₱2,589,306, or an average of ₱15.42 per thousand, to 207,396,000 in 1913, valued at ₱6,713,496, or an average of ₱32.36 per thousand. It will be seen that the average price has more than doubled since 1899.

There are two classes of cigarettes, machine and hand made, the former predominating. The cigarette machines mostly used are of French make, although a few American, German, and Spanish machines are also used. These machines are capable of turning out from 30 to 250 cigarettes a minute according to the class and type of machine used. The manufacture of

cigarettes, like the manufacture of cigars, employs some thousands of laborers, two-thirds of whom are females. Cigarettes are usually put up in packages of 30 each, although there is a small amount put up in packages of other sizes, this work being done mostly by women who are paid by the piece.

The production of cigarettes in the Philippine Islands has increased from 3,530,101,594 in 1906 to 4,500,771,926 in 1913. Exports have increased from 7,189,000 in 1902, valued at ₱19,990, to 52,040,000 in 1913, valued at ₱115,164.

The production and manufacture of tobacco is a vital factor in the source of wealth of the entire Archipelago and with the removal of all restrictions on the importations of Philippine products duty free into the vast market of the United States a door has been opened for the Filipino people, especially the agriculturalists, to materially increase the wealth of these Islands.

THE BUREAU OF AGRICULTURE EXHIBIT.

By W. A. MACE, *Agricultural Inspector.*

The agricultural exhibit was shown in a large building near the southern extremity of the Exposition grounds. This building was located on the west side of the main thoroughfare with the Bureau of Education and provincial exhibits as immediate neighbors on the south and north respectively, and facing the Bureau of Science and Bureau of Public Works exhibits on the opposite side of the thoroughfare.

One of the principal features of the agricultural exhibit at the second Philippine Exposition was the great number of competitive exhibits, as compared with the very few found at the first Exposition. A great number of the farmers responded to the wishes of the Exposition Board, and a good representative collection of the various products from the different provinces was gotten together and arranged in such a manner as to be shown advantageously.

It is hoped that the competition will be even keener in future experiments of this kind. The competitive exhibits of agricultural products are really of more value to the country as a whole than any other part of an exposition. They serve to create a friendly rivalry among the farmers which will do a great deal toward raising the standard for the various products.

The building.—The construction of the building was very simple, a shed-like structure 45 meters long and 20 meters wide with roof sloping downward from east to west. On the western side of the building the roof extended several meters over and

beyond the walls into the thoroughfare forming an arcade. The roof of this was supported by dressed and polished palma-brava posts, which gave a very beautiful columnlike effect to the structure.

A row of Bonga palms was placed in front of the arcade, and at each end of the building were beds of ornamental plants. The different colors of the flowers and foliage of the many varieties of cannas in these beds gave a very pleasing effect.

Inside the building the posts for the support of the roof were set in rows at intervals of 5 meters and at a distance of 5 meters from the side walls. This arrangement made it convenient to divide the space between the posts and walls into sections suitable for the various exhibits. Tables 2 meters long and 1½ meters wide were constructed around each post.

The method of displaying the material was of two general types. Walls of sawale 8 feet (2.4 meters) high were run from the posts to the side walls in the two end sections on each side and at each end of the building, making booths which were closed on three sides. This permitted the display of the material on tables, benches, and on the walls. In the other sections structures representing the halves of octagon-shaped kiosks were built and the exhibits for these sections were displayed on the floor, posts, roof, and ceiling of the kiosk, and on the tables and walls corresponding to the section. This gave eight sections of the booth type and eight with the kiosk arrangement. The space along the sides of the building alone was used for exhibits and the central part was reserved for the accommodation of visitors.

The interior of the building was decorated with flags and various kinds of decorative plants together with products from the various field crops. A ceiling for the entire building was made of flags; bird's-nest ferns were suspended from the ceiling at intervals of 3 or 4 meters; royal palms and other plants, which had been lifted and set in large boxes and pots for decorative purposes at the Exposition, were placed around the tables and by the side of the walls. All posts were decorated with some agricultural product such as palay, maize, and coconuts. Statistical charts and graphic maps and photographs pertaining to the various subjects exhibited in sufficient numbers to make the different exhibits as near as possible self-explanatory were hung on the walls of the booths or sections to which they corresponded.

Office.—One section was reserved for headquarters for the Bureau of Agriculture exhibit. While the Exposition was open,

an employee of the Bureau could always be found here to give out information, answer questions, and explain the details of the various exhibits. Other employees were also on duty in the different parts of the building.

Various publications of the Bureau of Agriculture were displayed and distributed here.

There were two blocks of crude rubber on exhibit in this section. These were the source of a great deal of comment and questions, from the visitors, which went to show the great interest in this industry.

Entomology.—The entomology exhibit consisted of a miniature locust corral, containing a great number of small locusts, which demonstrated the pit or driving method, large cases containing specimens of the various insect pests of the Islands in the different stages of their life cycle, and of nets and various other materials used in their control.

A small exhibit of the silkworm industry was displayed in this section by the Province of Cagayan. One other very interesting exhibit was the cages containing the various kinds of locusts, with charts describing their habits.

Fertilizers and farm implements.—This exhibit consisted of a display of various kinds of farm implements and tools and fertilizers of various formulas. The different ingredients which are used to make up a fertilizer were also shown in this section.

The implements were loaned to the Bureau by the American Hardware and Plumbing Company, the Pacific Commercial Company, and Mr. C. E. Helvie. The fertilizers were furnished by Behn, Meyer & Co. Here one could see the various types of plows and hand tools for the farm, and illustrations of the value of the various kinds of fertilizers. A number of pots containing fertilized and unfertilized plants were also shown in the fertilizer exhibit.

The College of Agriculture used two sections for exhibits of thesis work done by six students of this year's graduating class. Each student displayed a different kind of exhibit. There were shown the results of fertilizer tests with two different crops, one student having worked with tobacco and one with maize. One exhibit showed the results of seed selection, having used maize to demonstrate the importance of this practice. The resulting crops from a number of variety tests with sweet potatoes, yautias, and yams composed the exhibits by the remaining three students.

There was a great deal of material presented in these exhibits, but it was so well arranged and distributed in bins on shelves, as well as hung on the walls, that it made a very artistic showing

without looking bulky or crowded. The great quantity of the different kinds of material made a striking impression on the visitor, and when a close inspection was made it was found that the exhibits were very instructive, and that very valuable information regarding the articles exhibited could be obtained here.

One of the six students was to be found on duty in each of these booths while the Exposition was open. They were kept busy explaining the details of the exhibits and answering questions pertaining to the various articles.

Individual exhibits.—Two sections were devoted to the display of articles sent in by the farmers of the different provinces for the competitive exhibit. For these exhibits, one section of the booth type and one with the kiosk structure were used, and one could find represented almost every agricultural or horticultural product of the Islands. The posts, walls, roof, and tables of the kiosk, and the walls, tables, shelves, and posts of the booth were covered with small articles entered in the exhibition to compete for a prize.

There were a number of exhibits here which were of great interest owing to their superiority over the other articles of the same class. Among these were sugar cane from the Province of Batangas, and a large ubi from Cavite. Probably the most remarkable exhibit was a collection of bananas representing 36 varieties collected by a single grower from Cavite Province.

In the Bureau of Agriculture building alone there were more than 1,000 entries.

Rice.—The rice exhibit was one of the most instructive and interesting found in the agricultural building. The roof and ceiling of the kiosk of this section were made of unthreshed palay, while the posts, tables, and lower part of the kiosk were decorated with the same kind of material. Palay of different colors was used, giving a very pleasing effect.

In the center of the floor of the kiosk was a small bin filled with clean rice, and around this were several other bins which were filled with palay of different colors from some of the most prolific varieties. Around these bins and extending to the outer edge of the floor of the kiosk, and on the tables of this section, were a great number of small boxes containing samples of palay, loose in the box, and samples of the clean rice of the same variety in a small glass tube which was placed in the box with the palay.

The most interesting and instructive part of the rice exhibit was found on the wall. Specimens from a number of experiments were found here, among which was shown the result

obtained from a head to the row test, the results obtained from seed selection, and the results of variety tests. These experiments were made at the Alabang stock farm and Calauan by employees of the Bureau of Agriculture.

Fibers.—The fiber exhibit was beautifully arranged and presented a very artistic appearance, and proved to be very instructive. The roof of the kiosk was made of abacá, the ceiling, posts, etc., were decorated with other kinds of fibers, and the walls were covered with samples of the standard commercial grades of the different fibers.

The floor of the kiosk was divided into sections, in each of which was found one of the principal fibers of the Islands represented by samples of the fiber itself and some article manufactured therefrom.

The fancy grades, such as knotted abacá, were also represented. Here one was able to see the growing plants of maguey, abacá, piña, and a few more of the important fiber plants.

Coconuts.—The coconut exhibit consisted of coconuts and copra principally from Laguna Province. These were displayed in a very attractive manner and presented a very interesting exhibit. The roof and ceiling of the kiosk were made of coir fiber, while the posts, table, and lower part of the kiosk were decorated with coconuts.

Specimens of several varieties of coconuts were on exhibit in this booth, and the great contrast between copra produced by the different methods of drying was shown. The floor of the kiosk was divided into sections and in these were found steam-dried, sun-dried, and tapahan-dried (smoke-dried) copra side by side.

Various kinds of articles made from some part of the coconut, such as coconut oil from the copra and mats and brushes from the husk, were exhibited on the table of this section. Large nuts and samples of extraordinary well-dried copra were also exhibited on this table.

Sugar.—The sugar display was probably the most artistic appearing exhibit in the building and at the same time was interesting and instructive. The roof of the kiosk was made of cane tops while the posts, ceiling, table, and lower part of the kiosk were decorated with cane, the purple cane alternating with the yellow. In the center of the floor of the kiosk was a small bin containing refined sugar from the Luzon Refinery; around these were five small bins filled with three grades of centrifugal sugar from Macondray & Co.'s mill at Muntinlupa;

then around these bins, extending to the edge of the floor, were five other bins in which were displayed samples of the five grades of muscavado sugar. The latter were loaned to the Bureau by Warner, Barnes & Co. Specimens of a number of varieties of sugar cane were displayed on the walls of this section. Panochas of the different types and sugar in various other forms were displayed on the tables, together with bottles containing samples of sirup, sugar, etc., taken at different stages of the process of sugar making. Small quantities of the various kinds of materials used in the different stages of the process were also shown in small bottles making this table a magnet for those interested in the sugar industry.

Sugar and sirup from the sugar palm, together with a specimen of this species of plant, were also exhibited in this section.

Maize.—The maize exhibit was composed of white, yellow, and red maize, the greater part of which came from Bureau of Agriculture demonstration farms in Laguna, Iloilo, and Cebu. The large post corresponding to this section was covered with large stalks of maize from the La Carlota experiment station; each stalk bore one or two large ears. The most of the large ears displayed on the floor were grown at the Singalong experiment station. The roof of the kiosk was made of stalks of maize, the ceiling was of maize-leaf fodder, while the posts, table, and lower part of the kiosk were decorated with white and yellow ears.

In the center of the kiosk was a small bin filled with yellow and white maize meal; other bins circling this were filled with white, red, and yellow grain, and three rows of ears circled these bins filling the space to the edge of the floor. The table was covered with shelled grain, with a large star outlined in the center with a narrow strip of red grains.

Tobacco.—This exhibit contained both leaf tobacco and the manufactured products therefrom. The roof and ceiling were made of leaves and the posts, wall, tables, and lower part of the kiosk were decorated with loose leaves, or "manos," of tobacco. There were two large cases with glass fronts in this section in which were displayed cigars, cigarettes, and various other forms of the manufactured product. On the table and floor of the kiosk was displayed tobacco of the various grades, showing the methods of packing in different sections of the Islands. The different methods practiced in the Cagayan Valley, La Union, Abra, the Ilocos provinces, Cebu, and Iloilo were all

shown here. There were from three to five grades representing the methods of packing in each of the above-mentioned districts furnished by the Germinal, Tabacalera, Alhambra, and La Yebana factories of Manila.

This exhibit was made from material borrowed from the above-named factories together with some tobacco borrowed from the Province of Nueva Vizcaya and some which was obtained from the Bureau of Agriculture experiment station at Ilagan, Isabela.

Forage.—The forage exhibit consisted of a collection of the various kinds of forage plants and products of the Islands. The roof of the kiosk was made of sorghum, the ceiling of Japanese sugar cane, and two posts were covered with Rhodes-grass hay, and two with teosinte. The large post corresponding to this section was covered with peanut-vine hay, the table was decorated with pods of sugar millet, and the lower part of the kiosk was decorated with zacate, or barit grass. On the table were found several kinds of crushed feeds and seed of various kinds of forage plants. The real exhibit was on the floor of the kiosk, where products from the principal forage plants of the Islands were displayed, the greater part of which were produced on the various experiment stations and demonstration farms of the Bureau of Agriculture.

Plant propagation.—In this section were exhibited the various implements used in budding, grafting, pruning, etc., together with a number of budded seedlings and small plants. A number of seed flats, showing the proper construction and containing the various kinds of material such as soil, leaf mold, gravel, etc., used in the germination of small seed were also displayed here.

The great attraction in this booth, however, was the demonstration in budding, carried on by Filipino boys who have been trained in this work at the Singalong experiment station. A great number of valuable seedlings such as the avocado were distributed free.

Fruits and vegetables.—In this section an excellent exhibit of fruits and vegetables which were sent in from the Provinces of Cavite, Laguna, and Rizal was displayed and would compete very favorably with those from Baguio or any other place. The watermelons, cantaloupes, and cabbages attracted a great deal of attention.

In this exhibit one found almost all of the vegetables which are common in the Temperate Zone as well as those of the Tropics. A good appearance was maintained in the vegetable

exhibit by the supply of fresh vegetables obtained daily from the demonstration garden in the rear of the building.

A departure in the horticulture of the Islands was represented here in the form of banana figs, banana flour, and banana chips, which attracted a great deal of attention.

The Province of Cagayan exhibit.—The provincial exhibit buildings were burned just prior to the opening of the Exposition, and the Bureau of Agriculture was fortunate in having the exhibit of the Province of Cagayan assigned to space in this building. Aside from the breaking up of the scheme of allowing a sufficient amount of space for visitors, this exhibit was quite an addition to the agricultural building. It was an industrial exhibit and a demonstration of the methods practiced in each stage of the tobacco industry from curing the leaf to making the cigars. A number of women were kept at work in these demonstrations while the Exposition was open, and at the last stage in the process the cigars were made by hand and given to the visitor who happened to be on hand when one was completed. Nine small charts, each explaining a different stage of the process, were written in both Spanish and English and placed over the corresponding section.

Demonstration garden.—Aside from the exhibit of agricultural and horticultural products on the inside, there was a demonstration kitchen garden on the grounds in the rear of the building, and a great number of different kinds of vegetables were successfully grown here. The planting of these vegetables was timed so as to have the plants at a stage in their growth during the Exposition which would cast aside all doubt as to the practicability of their production in and near Manila.

There were eighteen small beds in the garden, each planted to a different kind of vegetable. In the back part of the garden was a germinating shed of a good type. Here were germinating flats with small seed planted and germinated during the time of the Exposition; demonstrations were also given in transplanting the small plants.

The garden was inclosed by a Page fence with galvanized-iron posts and gate complete, all of which were loaned by the American Hardware and Plumbing Company.

BUREAU OF FORESTRY EXHIBIT.

By E. E. SCHNEIDER, *Wood Expert, Bureau of Forestry.*

The exhibit of the Bureau of Forestry in the Second Philippine Exposition was planned on much broader lines than those of previous years. The exhibits of 1908, 1910, 1911, and 1912

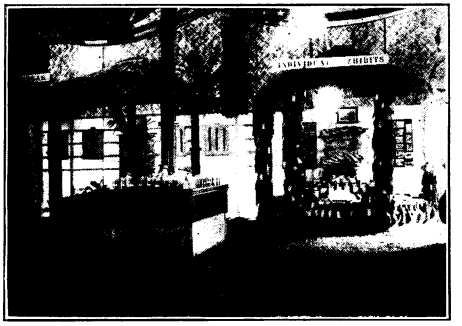
consisted almost entirely of collections of forest products, raw and manufactured, accompanied by pictures, statistical tables and placards, etc. This year the Bureau of Forestry asked for and obtained more than twice as much floor space as on any previous occasion, namely, 900 square meters, and it was planned to exhibit a number of industries using wood and other forest products.

Owing to the disastrous fire of January 26, which totally destroyed all the provincial buildings, over 200 square meters of space in the forestry building was given up to house the exhibits of three provinces. On this account, some of the proposed industrial exhibits were not put in while others were somewhat crowded together. Nevertheless, those which were shown demonstrated to the public certain phases of industries that are little known and aroused a great deal of interest.

The industries shown were of widely differing kinds. They included sculpture, by Garcia Velarde; the manufacture of musical instruments, by Pedro Buencamino; wooden-soled shoes, by R. C. Ibañez; walking sticks, by Eduardo Esteban; and of bent-rattan furniture, by Miguel Mendoza. In all of these exhibits operatives were at work a number of hours each day. Especially the shoemakers and rattan-furniture workers were always surrounded by two or three rows of interested spectators. Although every resident of Manila is familiar with that very ancient product, the wooden-soled shoe, and that most recent utilization (in the Philippines, at least) of rattan, the bent-rattan chair, few indeed had any idea of the skill and the appliances employed by their manufacturers. Similarly, it was no small surprise to many to see that a majority of the substantial-looking statues of saints and secular personages are made of a light, soft wood that the sculptor's chisels cut through so easily.

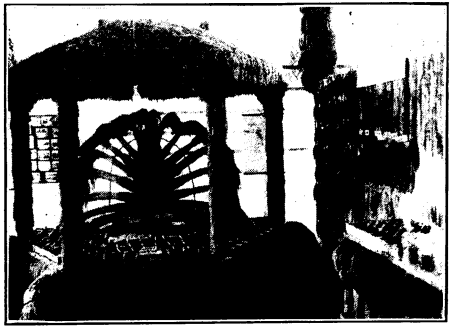
Beside the exhibits in which the actual processes of manufacture were shown, there were a number of others which contained more or less complete sets of specimens along given lines. The most conspicuous among these was a dining room 5 meters square completely paneled in supa, containing a dining set of the same wood, all polished in the natural color of the wood. The manufacturers of this exhibit, the Export and Import Lumber Company, spared no expense in adorning it, the green plush curtains and profuse equipment of cut glass and silver tableware setting off beautifully the golden brown of the wood. The floor in this exhibit was of narrow tongue-and-grooved lumbayao, while that in the next section, the general furniture exhibit, was

(*a*) Bureau of Agriculture fiber exhibit, 1914 exposition.

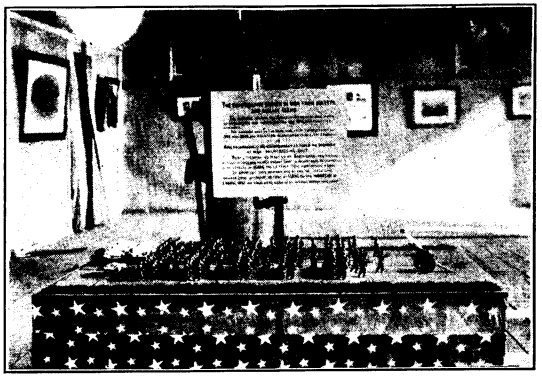


(*b*) Individual exhibits in Bureau of Agriculture Building.

(*c*) Bureau of Agriculture sugar exhibit.



(*d*) Bureau of Agriculture rice exhibit.



(*a*) Illustrating the relative danger in battle from bullets and disease. Bureau of Health exhibit.

(*b*) Large models of mosquitoes and flies.

(*c*) Large models of bedbugs, fleas and cockroaches.

of yacal, both manufactured by the same company; beside these there was also a sample panel of apitong from the Cadwallader-Gibson Lumber Company. All three of these woods make handsome and substantial floors.

In the furniture exhibit several pieces deserve mention, notably the articles manufactured from slabs of narra cut from abandoned stumps. Practically the only use made of the stumps is for table tops if the buttresses are large enough. The Bureau of Forestry had slabs of various sizes cut out from abandoned stumps to show that the prettiest figured wood is abandoned in the woods. Several of these unfinished slabs were exhibited as well as a tray and a set of tea tables made from a portion of them which were greatly admired and could have been sold for twice their value.

A palma-brava umbrella stand, which was made from a section of the columns used in the colonnade of the Exposition buildings, was on exhibit to show what could be done with this forest product.

Noticeable among less beautiful but none the less interesting exhibits was a complete bull-cart accompanied by a set of specimen wagon parts (tongue, reach, fellies, hounds, hubs, spokes, etc.) all made of guijo, a wood which, on account of its abundance, hardness, and compact texture, plays the principal rôle in the vehicle industry.

The 10-foot lauan and dao tables aroused the same astonishment and incredulity that they do among visitors to the museum; ten thousand eyes and a much larger number of fingers searched every inch of their circumferences for the joints supposed necessarily to exist in such immense tops.

A conspicuous feature of the decoration of the building, though somewhat obscured by the admission of the provincial exhibits, were the polished columns of tarao palm (*Livistona* sp.) along the two sides of the central nave. These palms, belonging to the same genus as the well-known anahao (*Livistona rotundifolia*), are found in inmense numbers in the valley of the Cagayan River. It was their use in the forestry building that suggested to the Exposition Board the application of this characteristic native product in the colonnades along the entire front of all the Exposition buildings. Some six hundred were so used, of which, however, more than half were destroyed in the fire.

Naturally, one of the most conspicuous portions of the exhibit was formed by the collection of 10-foot and 6-foot planks, which

now include nearly one hundred species. The Dipterocarp or Lauan family occupied over 20 lineal meters of wall space, comprising specimens, ranging from 1 to 4 feet in width, of yacal, narig, mangachapuy, guijo, red and white lauan, mangasinoro, kalunti, tanguile, tiaong, and palosapis. The brilliant woods of the Legume or Narra family, next in importance in the Philippines, occupied some 15 lineal meters and, as usual, attracted as much attention as their commercially more important, but less highly colored neighbors, the Dipterocarps.

At this exposition the public has had for the first time an opportunity to see the timber specimen and the tree in leaf. The hundred-and-odd logs exhibited were accompanied by over a hundred and fifty seedlings in tubs, pots, and bamboo tubes, the living plants comprising over fifty species and being placed in every case alongside the corresponding log specimens. The majority of the seedlings were raised and potted by the students of the Forest School at Los Baños and the remainder by the force of the Limay Forest Station, Bataan. The decorative effect of these plants was carried out above by hundreds of palm leaves and some scores of bird-nest ferns, lycopodiums, orchids, and other air plants suspended from the roof beams.

In the section adjoining the office of the exhibit were shown copies of the forest maps of the whole Archipelago and detail maps of important regions, accompanied by hundreds of photographs of forest scenes, typical trees, logging operations, and scores of other subjects allied to forestry. Also there was shown a complete set of the various forms and procedures employed for every possible operation of the administrative work of the Bureau, as well as forms and outlines showing the activities of the students at the Forest School.

Equally as novel and fully as interesting to the public as the industrial exhibits were moving pictures shown twice every day in the cinematograph room in the adjoining building. These comprised views of felling, rafting hauling, skidding and sawing logs, and handling the sawn product. The show was crowded at every one of the two daily sessions and hundreds who had never seen a really big tree in their lives here saw a giant of the forest fall and its dismembered trunk go through all the processes of conversion into saw-timber.

Five first prizes and one second were awarded to exhibits made by or under the auspices of the Bureau of Forestry, the five firsts for matches, sculpture, walking sticks, vehicles and parts, and cigar boxes, and the second to the rattan-furniture factory.

BUREAU OF HEALTH EXHIBIT, PHILIPPINE EXPOSITION 1914.

By Dr. J. E. SNODGRASS, *Assistant to the Director of Health.*

The Bureau of Health exhibit at the Philippine Exposition for 1914 was much more elaborate than ever before attempted. Heretofore, it has usually occupied a space of a few feet, but this year a space approximately 20 by 22 meters was secured and the exhibit so planned as to fill it comfortably. On account of the disastrous fire which destroyed the buildings provided for the provincial exhibits, permission was given the Province of Bulacan to utilize part of the space (about 7 by 11 meters).

An Oregon pine floor was laid over the entire surface which added materially to the appearance of the exhibit, as did the use of fine sauale to cover the rough walls and bunting to hide the overhead structural work.

The exhibit was wholly educational in character, and consisted of models, photographs, placards, and cinematograph pictures.

MODELS.

No. 1 (Plate VIII, *a*) represented two companies of soldiers marching, one against an opposing cannon, the other against a test tube used to indicate typhoid bacilli, and the relative incapacitation of the American soldiers during the Spanish-American war was shown.

The company marching against the cannon suffered the loss of only one man from death and incapacitation, while the company pitted against the bacillus of typhoid sustained a loss of one man by death and fourteen from incapacitation.

The soldiers were represented by tin models about 4 inches (9 centimeters) in height.

No. 2 contrasted sanitary and insanitary premises separated by a bamboo fence.

On the sanitary side of the fence was shown a neat, nipa house, a clean, grass-covered lawn having modern drainage facilities and provided with concrete walks, and a deep well with proper curbing and grading to prevent contamination.

On the other side of the fence a very different picture was presented. A dilapidated nipa house was located near an open, shallow, earth well and the slops from the house drained into the well. In place of grass was seen a rank growth of weeds; a mosquito-breeding carabao wallow was situated just back of the house while the broken-down, insanitary, and foul-smelling pig pen was located just abreast of the house and near the well.

No. 3 showed a plaster model, in miniature, of a sanitary barrio.

The streets were laid out in straight lines and the houses built to conform to the street lines. Modern drainage systems were shown; the streets were paved; proper house drains indicated; the ever-present estero was shown properly walled and bridged, and midden sheds or public-convenience stations placed at proper intervals.

No. 4 represented an insanitary barrio and presented a scene which was the exact antithesis of No. 3, having no street lines, no drainage facilities, and no system for the disposal of human wastes.

No. 5 represented a section of two rooms in a house; in one of which was shown a healthy, laughing baby with a nice vaccination scar on its arm, sitting up in a crib.

The room was represented as bright and sunny and flowers were on a near-by table, the whole atmosphere of the room being cheerful.

In the other room was shown a contrasting scene—a baby stricken with smallpox. It was represented as lying in a cradle, eyes swollen shut, hands bandaged, and body covered with the loathsome pustules of the disease. The room was darkened and on the table, instead of flowers, were medicines.

No. 6 represented sanitary premises. A large comfortable nipa house was shown conveniently located with reference to the street; proper drainage systems were illustrated, by cement drains leading to street drains of the same material; the street was paved and provided with a lighting system; the yard was covered with smoothly cut grass, and the whole premises gave the impression of being cheerful and comfortable, conducive to health and consequently long life.

No. 7 was a fair-sized model of a flowing artesian well. The various strata passed through during the process of drilling the well were shown. On the surface a pastoral scene was presented.

This model indicated the method by which satisfactory drinking water may be secured in the Philippines and also how the incidence of intestinal diseases can be greatly diminished.

No. 8 showed a wooden section of a rat-infested house with a glass front to afford an unobstructed view. Live rats could be seen in the insanitary garbage barrel in the street, after which they entered the house by burrowing under the walls or gnawing holes in them. Once in the house their nests were found in the hollow double walls, etc. Holes could be seen in the loose earth floor.

This model was intended to show the danger from plague in affording hiding and breeding places for rats.

No. 9 showed a section of a rat-proof house. This house contained no double walls or ceilings and the basement floor was cemented throughout thus preventing the entrance or burrowing of rats.

No. 10 indicated the use of rat guards on the hawsers of steamers tied to piers.

A beautiful model of a steamship was shown floating in artificial water and tied to a pier, but a sufficient distance from it to prevent rats jumping to or from the steamer. The rat guards were shown in proper position and rats were shown attempting to gain entrance to and escape from the ship by means of the hawsers.

As disease may be carried from one country to another through the medium of rats on steamers, the importance of rat guards and other precautions to prevent the ingress to or egress from steamers of rats, is obvious.

The above-described models were all supplied with explanatory placards printed in English and Tagalog.

Huge models (Plate VIII, *b* and *c*), having true proportion and coloring, were shown of flies, mosquitoes, bedbugs, cockroaches, fleas, and disinfecting pumps. These models were also used in the Carnival parade accompanied by signs with appropriate catchy legends and rimes. The disinfecting pumps were shown pursuing the insects. The models of the insects were approximately 2 meters in length and the pumps were about 40 centimeters in diameter and 2½ meters in height.

This exhibit attracted widespread attention and elicited much favorable comment both in the Carnival parade and in the Exposition.

Models of the Bureau of Health sanitary fly-proof pail for use where no sewer system exists, paper towels, and the latest types of garbage receptacles were also shown.

Samples of polished and unpolished rice were exhibited with placards showing the liability to beriberi from a polished-rice diet.

Specimens of the hookworm, ascaris, and other intestinal and blood parasites were exhibited as were a number of pathological specimens one or two of which illustrated the horrible effects of gonorrheal ophthalmia.

The contents of each of the three Bureau of Health simple-remedies packages were shown.

The new Culion leper colony currency was exhibited. The coins are made of aluminum in peso, and in twenty, ten, five, one, and one-half centavo denominations.

The coins are accepted at face value for all business transactions carried on at the colony and prevent the possibility of infected money being placed in general circulation, as the coins are without value as such outside of the colony.

Mounted specimens of the various species of mosquitoes found in the Philippines were exhibited in an attractive case. The mosquitoes commonly found in Manila were indicated by red name tags.

About twenty-five attractively framed photographs were exhibited. They illustrated the various lines of health work in the Islands and attracted considerable attention. Several of the pictures were enlarged to a size approximating 1 by 1½ meters and a number of them were handsomely tinted.

The subjects of the various pictures shown are as follows:

TITLES OF FRAMED PICTURES.

Culion Leper Colony. 4 frames with many views in each frame.
Philippine General Hospital. 3 frames with many views in each frame.
Landscape View of Baguio Hospital Division.
Bontoc Hospital Division. 1 frame with several views.
San Lazaro Hospital Division. 1 frame with several views.
The Deadly Fly.
Ordinary House Fly.
Front View of the Filthy Fly.
Flies on a Plate of Rice.
Dangerous Method of Serving Food.
Proper Way to serve Food.
Section of a Grain of Unpolished Rice.
Two Very Common Ways in which Water and Milk Become Contaminated.
The Horrible Effects of Gonorrheal Ophthalmia-blindness.
Cancers Resulting from Chewing the Betel Nut.
Tondo Market, Manila, 1914.
Insanitary Market.
Paco Market, the Most Modern Market in the Philippine Islands.
A Poorly Kept Cemetery.
Cementerio del Norte.

Fifty thousand copies of Health Bulletin No. 14, entitled "The Deadly Fly" were printed in English and Tagalog for distribution to visitors to the Exposition, and were eagerly sought for.

A well-equipped emergency station, with a doctor and nurse in attendance, was maintained as a part of the Bureau of Health exhibit. A handsome, high-powered gasoline ambulance was

stationed near this emergency station not only for emergency service but as an exhibit, to show the advantages of a strictly modern ambulance.

A moving-picture outfit was installed and health talks in Tagalog were given, illustrated by moving pictures and lantern slides depicting various lines of health work. This part of the exhibit proved to be very popular, the room being crowded to its capacity during the evening and night.

A number of photographs illustrating prosthetic dentistry and work on the eye, ear, and nose as done by Doctor Ottofy in the Philippine General Hospital, were shown.

It is believed that the exhibit accomplished unlimited good along educational lines.

THE SALES-AGENCY EXHIBIT.

By G. A. O'REILLEY, *Sales Agent.*

The Sales Agency's exhibit at the Exposition was almost entirely educational in plan and purpose. A sales department was conducted but only to the end that the object lesson presented might be given fullest expression. None but handicraft lines were exhibited and all of these were commercially sound or reasonably near a condition of commercial soundness. The series of processes shown was complete, and clearly expressed every stage included in the production and disposal of a finished article. Every finished article displayed was also represented by a similar article in process of construction. Lines shown were such as are capable of development in any part of the Philippines and their production involves but slight investment upon the part of the people.

The need for an authoritative display of this kind was marked in the extreme. The expositions of different years beginning with that of 1909 had given a strong impetus to the idea of local handicraft development. Embroideries, laces, crochet, hats, mats, baskets, woodwork, and a variety of other small industries had begun to claim the active attention of a hitherto unproductive population. Production increased in an apparently healthy manner. A local market was found and every one concerned appeared disposed to be good-natured and to assume that the other fellow, like himself, was doing the proper thing.

The turning point came, however, as it usually does in the experience of friendly business organizations, where an element of strict, cold business is introduced. The limit of local purchasing capacity was reached and it became necessary to consult the foreign market. Sad and unexpected things were brought to light, nearly every thing being wrong in some way. Embroidery designs were antiquated, methods of placing, filling, and delivering orders were hopeless, and each producer appeared to have a peculiar standard of his own which apparently looked good to him and which he persisted in following.

The variation in both quality and price of product was so considerable as to render foreign commercial operation upon any

considerable scale practically impossible. Low-grade material predominated and almost any shipment of considerable size when properly inspected in the United States disclosed a fatal variety of materials and grades. No definite standards of workmanship were recognized by either workers or local dealers with results which threatened to destroy even the small merit which the industry had developed.

Philippine mats quite acceptable locally, were rejected by the American dealer almost at a glance. Weight, construction, color, design, price, were all severely criticized.

The much-talked-of Philippine hat was also found to be in the undesirable class. The buntal, our best prospect, was known upon the American market in its cheaper grades only, but was called "Bangkok," and was supposed to be of Siamese origin. Other local hats were found to be impracticable for one reason or another.

Basketry, a line which because of the wealth of local husked basket fibers available and the natural manual dexterity of the people should constitute an important commercial line, was also in a bad way. Designs were such that generally the freight amounted to considerably more than the first cost of production. In most cases utility and a proper cost of production were sacrificed in the interest of an attempted artistic effect. Lace was struggling along apparently in the vain hope that some miraculous process would ultimately enable the Philippine product to compete in the markets of the world with a foreign product made by a cheaper, better-organized, and better-directed labor. Irish crochet, drawn work, and low-grade embroidery were in the same class.

This situation was directly attacked by the Sales Agency in its Exposition display. Correct materials, designs, models, methods, and prices were shown in a variety of forms. Forty experts were selected from the not less than 8,000 home embroiderers with whom the Sales Agency has come in contact during the year and upon each day of the Exposition they demonstrated the possibilities of this most important line. These and all other workers shown by the Sales Agency were paid a per diem sufficient to cover all unusual expenses incurred by them.

Through the courtesy of the Mother Superior of the Belgian convent of Tondo it was possible to show the processes involved in the production of Torchon, Cluny, Bruges, Guipure, Duchesse, Venetian, and Russian laces. Lierre and Princess appliqué were also shown. The little girls demonstrating these processes were nearly all foundlings and, under the expert direction of the

sisters, represented the highest expression of lace making to be found in this part of the world.

The buntal hat was selected as the one possessing the most extensive commercial possibilities, and seven of the highest-grade hat weavers in the Islands gave a daily demonstration of the details involved in the construction of this beautiful hat which when produced in commercial quantities will beyond reasonable doubt assert its superiority over the best Panama.

A certain style of hemp chinela (slipper) was selected as representative of one of the standard commercial possibilities of abacá in the handicraft connection, and half a dozen trained workers from one of the near-by provinces provided the necessary demonstration.

The working exhibit was confined to the four lines of embroidery, lace, buntal hats, and abacá chinelas, because of their superiority over other lines for local development.

The activities of the sales department of the exhibit were also confined to these four lines. Prices were definite, every article shown was commercially profitable and capable of production in reasonably large quantities and with definite assurance concerning deliveries up to the standard and within proper time limits. The walls of the building were covered with large display frames upon which was written carefully selected information upon industrial and commercial features in which the public might be interested. This information covered the relative values of different handicraft lines for local development, directions for workers, agents, and dealers, plans for provincial organizations, technical information concerning different lines of production and a variety of other forms of information calculated to facilitate the efforts of all classes of activity along industrial lines.

It is believed that the Philippine Exposition has reached the point in its development where a process of elimination of nonproductive details may be introduced with marked benefit. The collection of merely interesting things for the purpose of amusing the population is not by any means enough to justify the considerable expense involved. Each exhibit should bear more or less directly upon the general development of the material situation.

THE COMMERCIAL EXHIBITS.

By CLARENCE COLMAN, *Publicity Agent.*

With the stands, booths, and sections destroyed by the fire that swept the Exposition grounds, the business houses of Manila took hold with renewed vigor, and the task of preparing their exhibits went on apace.

The most beautiful display in the entire Exposition was the wonderfully illuminated tower of the Manila Electric Railway and Light Company. The tower rose high above its surroundings, shedding the brillance of its ten thousand white lights on the moats and grounds of the sunken gardens, a pillar of light plainly visible from Antipolo and Cavite. Within the base of this edifice were thousands of marvelous devices proving the efficacy of electricity in the simplest as well as the most involved tasks. Motors, fans, electric railways, cooking utensils, and household aids of all sorts were displayed and demonstrated by a host of men.

While not as vivid and splendid as its illuminated rival, the gas exhibit was a veritable wonderland of useful possibilities in heating and lighting by gas. In the first of the four large chambers devoted to this exhibit, motors and gas machinery were in operation, and the gas was let out in pipes to Calle Victoria where four great arcs made the night into day. In another room, a beautiful library and dining room were shown. Large lamps, desk lamps, and exquisitely decorated globes were displayed even as they are in the Home Beautiful. The bathroom was arranged with tubs, heaters, showers, and sprays of all sorts. In the last chamber, a kitchen was fitted up with all modern appliances to make the house-wife's lot an easier one. Ranges, wringers, and stoves and laundry aids were displayed and demonstrated.

The Pacific Commercial Company exhibited a large assortment of agricultural implements, from the simplest carabao plow to the large thrashing machines used so widely in the provinces.

The American Hardware and Plumbing Company had a varied exhibit of the different goods which the company has spread throughout the Islands. Sewing machines, sporting goods, and hundreds of the articles found at the big concrete structure in Manila were displayed.

The big Swiss milk firm, Lutz & Co., who have the agency for Bear Brand milk in the Philippines, had an exhibit of surpassing beauty. A bit of the Alps was portrayed, a Swiss village display in which the milk advertised was set up and sold.

Pathé Frères, the moving-picture firm which has a large agency in Manila, had an exhibit which featured the leading films of that company, beside showing different makes of cinematographs for homes and theaters.

The Hike Shoe Company had a worthy exhibit of its products. The merit of this exhibit is enhanced when it is known that all shoes, boots, slippers, etc., shown were made in the plant of the company on Calle San Marcelino in this city.

Many other business houses had model displays that attracted multitudes and drew comments of appreciation from all.

All the firms which had exhibits were more than repaid in immediate business by showing their products to the immense crowds that visited the Exposition daily.

So successful was the commercial end of the Exposition, that a movement has sprung up in Manila to arrange for a permanent exhibition of commercial wares.

THE AUTOMOBILE EXHIBIT.

By CLARENCE COLMAN, *Publicity Agent.*

Undeterred by the big fire which laid waste so great a part of the Exposition and which made necessary the housing of provincial and commercial exhibits in the building originally set aside for automobiles, the automobile agents of Manila took it upon themselves to erect a large fireproof structure in which to hold displays of their own.

This they succeeded in doing at extra expense, and when the Exposition opened a week later than scheduled the auto exhibit was one of the most comprehensive in the entire grounds.

The big building was walled and roofed with galvanized iron, a measure guarding against another devastating blaze, and the interior was arranged in an attractive manner which brought the automobiles and the motorists' aids prominently into view.

Throngs visited this building, and it is vouched for that over ₱100,000 worth of machines, etc., were sold during the time of display, and the subsequent results gained from this most excellent means of advertising are mounting up.

Without the building, an enterprising automobile agent, one of the most prominent in the Philippines, had put up a large electric sign with the name of the machine upon it in glowing lights. About this sign, on a small circular track laid out on the grass plot with a load or so of gravel, ran an automobile unguided by human hands, at the rate of 15 miles an hour. The wheel had been set at the proper angle to keep the car to the track and the steering apparatus had been safely locked. The auto ran in this manner for hours.

Within the building, the different firms of the Islands, representing the largest factories abroad that sell the leading makes of machines, had erected booths and displaying structures that impressed upon view.

The building was continually crowded and active interest was evinced by all who came to see and to glean instruction from

experts. Gleaming brasses, shining nickleware, spare parts, free engines, auto tires, and complete engines were displayed in decorative effects about the hall, while the autos held places of honor.

Small runabouts, roadsters, passenger cars of varying sizes and horsepower were centers of interested groups. Lectures on the merits of different machines were frequently heard, manufacturer's agents and individuals with no connection with the sellers of the machines offering sage advice.

The entire scene within was a replica of part of the big auto show at the Grand Central Palace in New York during the auto show of 1910. Decorations were well arranged and autos and auto aids were so placed as to gain immediate attention.

The auto show was a tremendous success from all points of view, and its financial value proved true early in the week.

HORTICULTURE EXHIBIT.

By Mr. MANUEL DE YRIARTE, *Second Assistant Executive Secretary.*

Among the most curious and interesting exhibits which the public admired in the last Philippine Exposition there figured—both on account of its novelty and the pleasing impression it caused to the eye—the very fine garden or park which, in charge of the floriculture committee, was established in a part of the walls overlooking the Exposition.

The crowds that attended the Exposition did not fail to visit this pleasant and delightful garden to such an extent that it was continually full of people who were anxious to see and admire the many different decorative plants there exhibited, which are produced so abundantly in this country—palms, begonias, roses, and incomparable orchids, among the latter of which there were a remarkable number from the Philippines.

It is impossible to exaggerate the energy that converted that abandoned, infected corner—hiding place of vermin and dumping ground of garbage—into the finest garden one can imagine. It is true that for this purpose a committee was formed composed of such distinguished botanists as Dr. E. D. Merrill and Mr. León M. Guerrero, and Mr. Oscar Schuetze, an enthusiastic amateur, and Mr. Fred M. James, an active and intelligent official in gardening.

Among the great variety of orchids, the collection of the above-named Mr. Schuetze deserves special mention on account of the diversity, number, and quality of exhibits. This collection consisted of 197 orchids, and of this number, 41 showed their pleasant and not-to-be-mistaken flowers. They, however, were not all native, for the exhibition was enhanced by some rare parasitic plants from Central and South America, India, Madagascar, Australia, and other countries.

Among others were seen the celebrated *Phalænopsis,* native of the Philippine Islands, and among these, certain hybrids, such as *P. intermedia* and *P. portei,* all of them specimens cared for with the zeal of those initiated in the mysterious cult of orchids. There were also four plants of the genus *Vanda* of these Islands, all in blossom, and among them the much-sought-for *Vanda sanderiana,* which very seldom flowers at this time of the year. Besides this, there were on exhibition several specimens of the genus *Dendrobium,* family Epidendreæ, in blossom,

such as the *Dendrobium schuetzei* from Mindanao, and one other, a natural hybrid from Australia. Very remarkable also were the varieties of *Cattleyas, Laelias,* and *Laelio-cattleyas* from South America, one of them, *Catleya schroderæ,* representing the extreme beauty of the flowers of these parasitic plants.

The exhibition of orchids in this charming park, and especially the collection of Mr. Schuetze, is a clear proof of what could be obtained from the intelligent and zealous cultivation of these plants that are kept with so much care and pride in the hothouses of the potentates of Europe and America. This Archipelago is indeed, on account of its geographic situation and climate, the richest in precious parasitic plants, so that it is surprising that their cultivation, which ought to be a source of income for the inhabitants, has not yet attained the prosperity which it deserves. It is to be expected that the success of the floricultural exhibition will greatly stimulate interest in their cultivation.

Up to date those who devote themselves to it are very few, and the Filipino gardener, Mr. Regino Fermin, whose collection attracted much attention on the part of the public, is indeed an exception, for he has devoted himself for more than forty years to the exportation of orchids, supposedly with success. In this collection the public admired three splendid specimens of *Phalænopsis schilleriana* never seen here before, no one of which had on its stems less than two hundred buds. The most beautiful specimen was sold for nearly twenty pesos.

Of this exhibition, much has remained of what had been planted in the garden itself—some beautiful and rare ornamental plants, native and foreign, climbing plants, several palms, etc. Therefore, the garden still exists. Now, is it just and reasonable that it should be abandoned, and that this place become again what it was before the Exposition? It is suggested that the department of sanitation and transportation of the municipality of Manila, which contributed so much to the success of the exhibition, should take charge of this garden. It could continue as an exhibition of decorative plants, from which foreigners could form an idea of the riches of the country along this line, particularly with respect to orchids. Private persons could keep and cultivate their orchids in this place under the care of a municipal gardener, being sure that it is the most suitable place for them, and also show foreigners the specimens they possess. The expenses would be so insignificant, in view of the material and artistic results, that it would hardly be worth mentioning.

WATERFALL EXHIBIT.

By A. GIDEON, *Chief Engineer, Department of Sewer and Waterworks Construction.*

The waterfall which represented the exhibit by the city of Manila was located near the Victoria entrance to the Walled City. The design and construction were prepared and carried out under the direction of Mr. A. Gideon, chief engineer, department of sewer and waterworks construction, the work being in direct charge of Mr. Roman Mercado, draftsman in the same department.

The contribution to the cost of the construction of the exhibit by the Municipal Board was ₱3,000. It is expected that the total cost will not greatly exceed the amount stated, inasmuch as a good deal of the material used in this construction can be used again later on in other works after the waterfall is dismantled.

The length of the crest of the waterfall was about 40 feet (12.2 meters), which, to economize in the water, and to give it a more rugged appearance, was broken up by projecting rocks into several channels. The entire structure, together with the wings representing the gorge was about 150 feet long (45.7 meters). The structure consisted of a wooden framework, adjacent to the city wall, over which poultry-wire meshing had been spread in irregular form, and this was covered by painted cotton cloth and canvas which gave it a very rugged appearance, as if actually made of rock. Plaster of Paris was used in a few places to give the appearance of moss, rocks, grass, etc. Depressions in the surface were made to represent grottos, and the projections were made of "rocks" built of the same material as the fall itself.

The water was furnished by four 2-inch galvanized-iron pipes connected to the Victoria Street main, and controlled by stop-cocks so that any amount within the capacity of the pipes could be delivered to the tank on top of the wall. The tank was about 12 feet wide (33 decimeters) and the overflow of the tank passed over the top of the falls, breaking up into a number of streams

which gave the appearance of a considerable body of water, although as a matter of fact there were not more than 150 gallons of water per minute used for the purpose.

By leading small pipes from the tank to various parts of the supposed mountains little streams of water were made to trickle from the pseudo rocks, adding a natural effect. The water flowing over the brink was received in an artificial pool formed by an embankment around the base of the waterfall structure, the water from which was led off into the adjacent drains.

Arrangements were made to reuse this same water over and over again in case a larger body of water should be desired to give it the appearance of more volume. The bottom of the tank was paved with a rather lean layer of gravel concrete about $1\frac{1}{2}$ inches thick (3 centimeters), which, however, was quite watertight. In this pool or pond a number of aquatic plants were placed and a couple of turtles and a lizard.

Native palms were placed back of the edge of the falls on the sides, and these, together with the foliage of the trees growing on the street behind the wall, furnished a final touch to the natural appearance sought for in the exhibit.

The entire force employed on the construction of this exhibit did not exceed at any time ten men, including the man in charge of the work and six painters and sculptors.

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES.

By the DIRECTOR OF THE WEATHER BUREAU.

JANUARY, 1914.

(Temperature and total rainfall for 24 hours beginning at 6 a. m. each day).

Date.	Abacá (Manila hemp).				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		San Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	24.6	41.2	26.2	12.1	24.7	11.2	25.2	-------	20.8	4.9	26.2	-------
2	24.4	79.5	25.6	6.1	26	1.3	25.5	-------	22.1	-------	26.7	-------
3	24.2	21.1	25.9	4.4	26.2	-------	26.4	-------	21.8	-------	25.9	-------
4	24.1	9.1	23.9	30.5	24.1	6.1	26.2	-------	20.9	-------	26.4	-------
5	26.3	-------	25.6	-------	25.8	-------	26.2	-------	23	-------	26.8	-------
6	26.1	-------	25.6	-------	25.7	-------	26.3	-------	24	3	26.6	-------
7	24.2	-------	25	-------	25	-------	26	-------	22.8	.6	27	-------
8	25.3	11.4	24.6	1.3	25.4	-------	24.6	-------	20	5.2	23.5	-------
9	24.2	-------	24.8	2.8	24.6	-------	23.7	-------	19.7	-------	23.8	-------
10	24	-------	23.7	-------	24.1	-------	24.5	-------	20.1	-------	23.5	-------
11	24.4	-------	24.4	1.8	23.4	-------	22.8	-------	20.7	-------	22.9	-------
12	25.5	11.9	24.1	59.1	23.7	1.5	23.7	-------	21.4	-------	22.8	-------
13	24.8	4.8	25.9	1.8	25.8	-------	24.8	-------	22.4	-------	23	-------
14	24.2	7.3	25.7	1.3	26.3	-------	25.4	-------	23.6	-------	25.5	-------
15	25.5	1.8	25.7	-------	25.6	-------	25.2	-------	23	8.1	25.6	-------
16	25.8	-------	25.4	2.5	24.5	-------	25.2	-------	22.6	-------	25	-------
17	25.9	-------	24.7	1.8	25.5	1.3	24.7	-------	22.9	1.5	23.8	-------
18	26.4	-------	25.6	.8	25.4	-------	25.6	-------	23.3	-------	26	-------
19	26.2	-------	26	3.3	25.7	-------	25.3	-------	23.7	-------	25.2	-------
20	25.2	3.8	24.3	43.1	25.7	-------	26.8	-------	23	47.3	24.6	-------
21	23.7	7.1	25.4	2.5	26.1	-------	25.2	-------	21.2	5.9	24.4	-------
22	25.5	.3	25.6	-------	26	-------	24.4	-------	22.4	-------	24.6	-------
23	26.1	2	25	2.8	25.1	-------	25.3	-------	22.7	-------	25	-------
24	24.6	3.3	25.8	-------	25.9	-------	25.3	-------	22.6	-------	24.4	-------
25	25.9	-------	25.1	2.5	25.5	-------	25	-------	22	9.5	25.8	-------
26	25.5	3.8	24	14	24.4	-------	25.1	-------	22.4	.5	23.8	-------
27	25.9	1.6	25.5	-------	25.8	-------	25.4	-------	22.7	2.8	24.1	-------
28	25.7	-------	25.2	-------	25.2	-------	25.7	-------	22.2	2.3	24.5	-------
29	25.4	-------	25.2	.5	24.8	-------	26	-------	21.6	6.1	26	-------
30	25.6	-------	24.9	7.3	25.6	-------	27.2	-------	22	3.5	26.8	-------
31	26.4	.5	25.9	.8	26.4	-------	27.2	-------	22.5	-------	27.2	-------

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[1] On leave.

Kaong, or sugar palm; young tree.

THE PHILIPPINE

Agricultural Review

VOL. VII MAY, 1914 No. 5

CONTENTS.

ILLUSTRATIONS.

EDITORIAL.

KAONG, OR SUGAR PALM.

For many years the Filipino farmer, especially in the Province of Cavite, has been accustomed to tap such specimens of the kaong, or sugar palm, as happened to be of easy access; and, without apparent effort to improve any feature of the industry, he has made comparatively large profits from the sale of sugar, sirup, and vinegar. The sugar and sirup, however, are of a very objectionable color and have a rather strong taste, due in part at least to the excess of lime used in the attempt to clarify the sirup; a slight change in the method of clarifying, however, has, it is believed, changed the economic status of this tree, which can now be classed as an economic crop plant of very high value. Articles in the present number dealing both with the current field practices and with the technical improvements which should be instituted therein, throw an entirely new light upon the question.

By hard work, costly apparatus, and very expensive agronomic operations, the sugar-cane planter can in favorable seasons obtain 5 or possibly 10 tons of sugar per hectare; the Filipino kaong tapper, according to estimates based upon records discussed in detail in this issue can, it appears, obtain no less than 20 tons of sugar per hectare.

Moreover, the kaong takes care of itself; if assisted beyond the grass-poison period, it can be grown on the poorest cogon lands, rocky hillsides, and waste land in general; its bearing period extends over ten to fifteen or more years without replanting; it is but little subject to damage by droughts, typhoons, insect pests, or fungous diseases; its sap contains 20 to 40 per cent more sucrose than that of the average sugar cane; the harvest period extends over the entire year.

In short, we feel fully warranted in presenting this crop to the public in this new light with the belief that the kaong can in the near future play a very important part in Philippine agriculture. If given due attention it could even excel in most respects the much more recent but more highly developed and better-known sugar cane.

REDUCTION IN SIZE OF REVIEW.

It appears, at the present time, that it may be necessary to make some reduction in the size of each number of the Review to be issued during the remainder of the current year. This action is unavoidable on account of the limited funds that are available for this work. In connection with the decrease in size, however, a correspondingly increased effort will be made to improve the quality of the material published.

BUREAU OF AGRICULTURE CIRCULAR No. 29—GUINEA GRASS.

[CIRCULAR No. 29. Manila, P. I., April 1, 1914.]

GUINEA GRASS.

By H. O. JACOBSON, *Acting Chief, Division of Agronomy.*

Guinea grass (*Panicum maximum* Jacq.) is a prominent member of a family of grass plants numbering approximately 600 species, mostly tropical.

This perennial variety is said to be a native of tropical Africa, but is now extensively grown in tropical America, the West Indies, and other countries offering similar climatic conditions.

A number of stools (roots) were brought to the Philippine Islands in 1907 from the Hawaiian experiment station, Honolulu, twenty of which arrived in good condition.

These were divided and planted and thereafter, at frequent intervals, redivided and replanted so that the following year somewhat more than half a hectare was growing. From this original planting roots were distributed to the various experiment stations of the Bureau of Agriculture; then Army posts, Insular officials, and private individuals were supplied. By July, 1909, 61,000 roots had been sent out and at this writing (March, 1914) the number distributed runs well into the hundreds of thousands, with the demand on the increase.

Value.—Guinea grass is highly valued in Cuba and Porto Rico, and in Jamaica is said to be second in value only to sugar. In Jamaica it supplies the greater part of the green forage for the cities and is brought in on the backs of donkeys and peddled about as "zacate" is in Manila. Prof. F. S. Earle, of the Cuban department of agriculture, is quoted as having said "As to Guinea grass, it is the best forage grass in the world."

When interest was awakened in this grass for forage purposes considerable doubt was expressed as to its food value, and in 1909 the Bureau of Agriculture, in coöperation with the land transportation office of the Quartermaster Department, United States Army, conducted a feeding test. It was then determined that as a green forage it met all requirements.

Samples of various sorts of green forage were later submitted to the Bureau of Science for analysis, and these were reported upon as follows:

	Balili zacate.	Barit.	Guinea, fresh.	Manimanihan.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Water	82.56	68.84	77.85	67.39
Ash	2.19	6.64	2.85	3.69
Proteids	2.96	2.76	3.34	4.28
Carbohydrates	6.71	11.88	8.09	7.86
Fat	.90	1.51	.57	8.09
Fiber	4.68	8.37	7.30	8.69

It will be noted that in the most essential elements—proteids and carbohydrates—guinea grass was superior to either balili or barit, everything else considered.

Palatability is a prime consideration with a forage plant and guinea grass is greedily eaten by carabaos, cattle, goats, pigs, horses, mules, guinea pigs, and chickens.

During the last year, frequent applications for roots have come from persons who have found guinea grass a very convenient and excellent means of providing tender, fresh green food for poultry.

Production.—In 1908 at the Singalong experiment station three-tenths of a hectare was planted in rows 1 meter apart with plants one-half meter apart in the row. Four cuttings were made during the first six months from January 1 to July 1, inclusive. The following table gives growing period in days, yield, and cost per 100 kilograms.

Cutting.	Growth.	Yield.	Cost per 100 kilograms.
	Days.	*Kilo.*	
First	66	4,278	₱0.62
Second	42	4,640	.39
Third	35	8,275	.64
Fourth	40	4,350	.14
Total	183	21,543	
Average			.45

In other words, the rate of production in round numbers was 72 metric tons in one hundred and eighty-three days.

Another plot of one-fourth of a hectare planted in April in a field which had previously been planted with maize, given one light irrigation but no fertilizer, produced a crop in sixty-one days of 41 metric tons per hectare. Yields at larger and smaller figures have since been reported from various sources, but with

ordinary care, an annual yield of 120 tons of green grass per hectare may reasonably be expected. At least this figure has been the more common one for large areas on the experimental farms. Special attention to irrigation, cultivation, and fertilization increases the yield very materially.

Soil.—While the plant adapts itself to a wide range of soils, it prefers a somewhat sandy, well-drained soil. Moisture, of course, is necessary, but an excessively wet soil or one subjected to standing water will not grow guinea grass successfully.

One of the first lots sent to the Alabang stock farm was transplanted in low, heavy, rice land, but did not do at all well there. Later this same lot was removed to a hillside where it grew very much better as better drainage was possible.

Other requirements.—It is well known that for thrifty growth, plants require an abundance of water, plant food, sunshine, and air. While guinea grass does grow well with little care and no irrigation, the added results obtained by giving cultivation after each crop is removed, an occasional fertilization, and irrigation, well repay the extra expense. On unirrigated land the roots should be set out at the beginning of or during the rainy season, and the field should have sufficient slope to provide rapid escape for surplus water. If such fields must be transplanted during the dry season, water should be used liberally on each plant when set out.

Preparation of the field.—The field should be located as close as possible to the place where the forage is to be fed, to avoid loss of time and expense in transporting the forage to the animals. It should be plowed not less than 15 centimeters deep and the soil worked into a fine tilth. The rows should be laid out 1 meter apart and a furrow run for each row with a rice plow. If planted during the dry season, water should be run into these furrows. If cattle or horse manure is to be applied it should be put on before the field is plowed, or be applied after the crop is established, and then cultivated into the soil between the rows.

Planting.—The "ponos" or stools consist of a large number of apparent divisions. These may be pulled apart into sections the size of two or three fingers; these should be placed in the furrow from 50 centimeters to 1 meter apart, and the earth packed firmly around each root, allowing a small part of the stem to protrude above the surface.

Until there is an abundant supply of roots close planting is not advocated, as the increase in yield does not seem to be much affected by it, although the stems tend to be finer. After

the plants are all set the field should be given a thorough cultivation between the rows to loosen the soil. No weeds should be permitted to grow.

Whenever the grass has been cut two times or more, if it is desired to increase the area, the roots may be again divided and replanted, thereby doubling the area each time.

Propagating by seed.—There is a general belief that guinea grass is commonly propagated by sowing seed, but so far this method has not been practised here. In many parts of the world, it is reported, the plant does not bear seed, although seed is regularly produced in the Philippines. However, the seed matures very unevenly, and shatters easily, and the only practicable method is to gather the heads as they ripen from day to day, dry them, and thresh when dry. The seed may then be planted in hills very much the same way as maize or sorghum, with the rows 1 meter apart and the hills 50 centimeters to 1 meter apart in the row, placing about 10 seeds in each hill and covering with about 2 centimeters of soil. Moisture must be present to aid rapid germination. This method should be attempted only at the end of the rainy season, unless irrigation is possible.

It is doubtful whether propagation with seed will ever be as satisfactory as propagation by division of roots. When seed is grown there is naturally a loss of forage in the area producing seed, and plants grown from seed require considerably more time to attain the same productive stage as plants from divided roots.

General information.—When a plantation has been cultivated for a time a deterioration in production and quality will be noted. This is due to various causes and in heavy, nonirrigated soils takes place in about one year; in other soils this condition may be deferred for a considerably longer period. When this occurs, the stools should be dug up, divided, the field replowed and thoroughly cultivated, and, if possible, fertilized, and the plants reset. However, removal to a new field is preferable, especially one where either cane or maize had previously been growing.

Applications of thinly scattered cattle or horse manure, or guano, will stimulate the growth of the plants remarkably.

If it is desired to use chemical fertilizers, an application of 300 kilos of Manila tankage every four months may be made. Sulphate of ammonia, nitrate of soda, or calcium cyanamid may be used sparingly, say, 100 kilograms per hectare, taking

care that their use is not too expensive when compared with the increased yields thus obtained.

How to secure roots.—The Bureau of Agriculture has been distributing roots since 1908 under the following conditions:

For sufficient roots to set out 1 hectare a charge of ₱15 will be made. Sufficient plants to set one-tenth of a hectare will be furnished without charge, but for additional plants a charge of ₱1.50 for one-tenth hectare will be made. In all cases the transportation charges will be paid by the applicant.

Except in very unusual cases it is more economical and satisfactory to secure the usual free distribution of 100 plants, since if shipment must be made any distance the charges remain nominal, whereas with the larger number the cost is considerable. Furthermore, those distributed free can be rapidly divided and the increasing number will soon plant the desired area; in the meantime the grower will have an opportunity of learning the habits of this plant.

It should be remembered that the twenty original roots received by the Bureau of Agriculture produced in two years sufficient plants to set out 10 hectares.

In applying for roots, shipping instructions should be specifically stated and the name and address should be plainly written.

No seed is carried in stock for distribution.

THE SUGAR PALM.

By O. W. BARRETT, *Chief, Division of Horticulture.*

In the byways of tropical agriculture there is no more interesting case of neglected possibilities among the major crops than that of the sugar palm (*Arenga saccharifera*). This plant, mentioned in Sanskrit writings, is one of the oldest economic species used by civilized man; yet, with the possible exception of a few semicultivated plantations in Malaya, there has probably never been a case of using this palm as a major crop under strictly agronomic conditions.

The world has just begun to realize that a deplorable waste of material in the way of palm sugars has been for a long time a negative fault of modern crop work in the Tropics. India in particular now realizes that very large profits can be made through utilizing the extensive stands and semicultivated groves of the wild date (*Phœnix sylvestris*) of Bengal, and the palmyra (*Borassus flabelliformis*) of southern India and Ceylon. In the Philippines, also, there are four palms capable of greatly increasing the sugar production, though one of these, the coconut, is too valuable as a producer of copra, and another, the nipa (*Nipa fructicans*), is likely to be for some time used more as an alcohol crop. The burí (*Corypha elata*) will undoubtedly be held in higher esteem in the future, when the methods of tapping it are better worked out and a way around the difficulty of its late maturity is found.

The two or three forms of the kaong, or sugar palm, are fairly common throughout southern Luzon and although never planted, are coming to be recognized in Cavite, Laguna, and Tayabas Provinces as crop plants more or less worthy of attention. By the same token, it would appear that the kaong attains a greater development and matures sooner in southern Luzon than elsewhere (in Malaya and the East Indies). In Simmonds, "Tropical Agriculture" we are told that this palm, known as "gumuti," is "fit to yield toddy when 9 or 10 years old, and continues to yield it for two years at the average rate of 3 quarts a day." In Cavite Province our investigations in-

dicate that the kaong begins to flower at the fifth or sixth year, at least when the tree has plenty of room for development. Moreover, its economic life extends over a period of no less than ten and probably in most cases of over fifteen years. The yields recorded in the following article would indicate that the Philippine form of this palm is a much more valuable plant than the South Indian.

Although the irregularities in the flowering habits of this palm would indicate a differentiation into types and forms through prolonged cultivation and selection, there is no historical evidence, at least in the Philippine Islands, to show that such a factor has ever had the slightest influence upon the kaong. About 90 per cent of the trees observed are monœcious, i. e., both male and female flower clusters are produced on the same plant; the so-called "male" palms are evidently semisterile individuals producing almost always abortive female flowers. These "males" are selected by the Filipino farmer as starch trees, and with this end in view he chops off the flower bunches as soon as they appear in order that the valuable food materials in the trunk may not be exhausted through the tree's effort to produce fruits, or rather flowers, from the semisterile bunches.

It appears there has been considerable misunderstanding in literature regarding the flowering habits of the sugar palm. For instance, Simmonds informs us that the first bunches open at the "top of the stem, the next lower down, and so on until at last it yields one at the bottom of the trunk with which the tree terminates its existence." Irregularity in position, time, and number of flower bunches is a marked feature in our observations.

The dayumaca (*Arenga tremula*), a fairly common species in the mountainous districts of Cavite and Tayabas Provinces, is said to be used to a limited extent as a sugar, or rather *tuba*,[1] producer; and Watt [2] states that the dadsel (*A. wightii*) is also often tapped for "toddy."

The difficulty in making first-class sugar from kaong tuba, or sap, has been largely due to the amount of proteid substances held in solution. Experiments have been directed, therefore, toward the best means of precipitating these gumlike albuminous compounds, so that a clear sugar solution could be had for open-kettle boiling. Prevention of fermentation in the sap before it reaches the kettle has been another troublesome matter.

[1] Sap, used unfermented, or fermented, as a drink.
[2] Commercial Products of India.

With these difficulties overcome, however, the Philippine planter has a new line of work open to him, and one which, in our opinion, will sooner or later be a permanent feature in Philippine agriculture in the broad sense.

Some writers have calculated that 400 trees per hectare could be planted, but even with this unusually large number Tschirch [1] observes that the yield of sugar per hectare is not large enough to make the crop a really successful one; the yield in Java is only about 4 tons per hectare. According to our investigations, it appears probable that 1 hectare containing not less than 150 trees nor more than 200 should produce under modern cultural methods some 20 or more tons of marketable sugar per year over a period of ten to fifteen years; this yield, considering the extremely low upkeep expense, compares very well with that of the best sugar cane.

The kaong is not strictly a jungle species and seems to prefer the banks of mountain streams, margins of forests, and partially open hillsides. It can compete successfully with cogon, but if given protection from the injurious weeds and undergrowth during its first three years a much more rapid growth is, of course, attained. The spread of leaves is not quite so great as with the coconut, but the weight of the crown is much greater, the leaves being longer and heavier but attached along the 3 to 5 meter "head" of the trunk so that they do not droop outward nearly to the horizontal, as in the case of the coconut leaf. The trunk itself is usually much thicker, but shorter, than that of the coconut. The height of the trunk at the appearance of the first flower cluster is about 4 or 5 meters; well-developed trees attain a height of 12 or 15 meters including the leaves. The trunk is always vertical, unlike that of the coconut. The bases of the leaves are surrounded by a mass of black fibrous material composed of an inner soft and shining substance of a beautiful brownish-black shade, and a mass of coarse black filaments, more or less rigid and of little value. This fiber gives the tree its local Spanish name, "cabonegro," or black head. In commerce the inner fiber is known as gumuti or eju. It is used throughout the Philippines in making ropes for use in salt water; this rope is said to endure alternate wetting and drying or continued exposure to either fresh or salt water better than any other rope material in the world.

The kaong is seldom attacked by insect pests, though in a

[1] Indische Heil und Nutz-Pflanzen.

district badly infested by the rhinoceros beetle some slight damage may be in evidence.

The pericarp, or outer pulplike husk of the fruits, which contain three hard-shelled seeds, is filled with needlelike raphides, or irritating crystals, which cause severe itching if brought into contact with the skin; both bats and wild pigs, however, feed upon the ripe, pale-yellow fruits. The kernels of the seeds are occasionally used in desserts, being simply boiled in sugar, with spice or some flavoring substance added; the endosperm is by no means so good in flavor, however, and probably is less nutritious than that of the coconut.

For one to three weeks before tapping the stem of the male flower bunch is beaten (if it can be easily reached from the ground) or pulled about twice a day, morning and evening, in order to induce a greater flow of sap into the peduncle. The whipping or beating is never severe enough to break down the tissue of the flower stem, and it is a question whether either this or jerking the bunch by means of a cord or strip of bamboo is really of much direct value to the tapper, who is usually inclined to follow local superstitions and traditions in the matter of routine details in managing the tapping and gathering processes. For instance, the (easily explicable) cessation of sap flow in the case of one tree under observation was attributed to the fact that one who *was not the owner of the palm* had been collecting the tuba (for records) and that the tree had naturally (sic) resented it.

As soon as the flowers in the bunch open the stem is severed at about the point where the first pedicels are given off, i. e., 40 to 60 centimeters from the trunk of the tree. In common practice the end of the cut stem is rubbed thoroughly with the crushed fruits of the wild pepper (*Capsicum frutescens*); the cut end is then wrapped in a banana leaf or something similar to protect it from drying out, and this is left *in situ* for one to three days, until the flow of sap begins. There may be a slight drip the first or second day after cutting, but not until the third day, usually, does the sap flow fast enough to make it worth while to attach the "panahod" or bamboo joint, holding from 2 to 6 or more liters. It is believed the maximum flow, in most cases, is reached some time during the first three weeks after tapping. Individual variations and fluctuations due to temperature, rainfall, etc., may considerably influence the flow and the time at which the maximum is attained. Some tappings, if not carefully managed, stop rather suddenly, while

others may run for eight or ten weeks when they gradually fall to the unprofitable-yield point. A thin slice of the stem is cut off, early in the morning and again late in the afternoon, at the time of gathering the sap; the crushed pepper fruits are rubbed over the freshly cut surface each time, and immediately thereafter a greatly increased flow occurs, presumably influenced by the effect of the exceedingly penetrating principle of the peppers. At the termination of the flow the end of the stem is seared over by holding a burning wad of fiber against it; this dries up the tissue and stops any leakage.

A cut is made on the underside of the cut end of the peduncle so that sap flowing down over its nearly vertical surface will drip from the improvised lip instead of running back down the peduncle toward the trunk of the tree. When the sap is collected for sugar making, clean panahods must be used every time, because if the yeast ferments were present in the panahod at the beginning of the half-day's flow, fermentation would begin at once and thus considerable sucrose would be lost by the time the panahod is emptied.

Frequently a small quantity of crushed ginger or of the wild-pepper fruits ("siling labuyo") is placed in the panahod when it is hung on the peduncle; the sap dripping down upon the ginger or pepper takes up enough of the quasi-antiseptic principle to prevent action of the yeast ferments and bacteria for several hours. When collected for vinegar, however, no effort is made to deter fermentation in the panahod. When tapping on a large scale for sugar it would be advisable to collect the tuba every three or four hours, and it might be well to add a few centiliters of alcohol to the panahod at the time of hanging it.

It would undoubtedly be better to remove all female flower bunches on the tapped trees to conserve the forces of the plant; 4 to 6 huge bunches of fruits, each weighing 100 kilos or more, are frequently in evidence on trees which may be giving a sap flow from one or two male stems at the same time.

Further data regarding the yield of starch or sago in the case of the so-called "male" palms is being collected. For the present, however, we may state that well-grown trees are said to give as much as 2 cavans (some 100 or more kilos); the average tree in Cavite Province would yield, it appears, about 1 to 1½ cavans (say, 50 to 75 kilos). Doctor Roxburgh [1] states that a trunk under his observation (in India) yielded some 67 kilos (about 150 pounds).

[1] Simmonds: Tropical Agriculture.

Considering the kaong then as a combined fiber, starch, and sugar crop, there is unquestionably an excellent future for the Filipino planter who is willing to give a little extra attention in the way of improvement of methods to this palm. The use of the plant for production of vinegar or alcohol may also be worth considering, especially if the local market is good. It is unfortunate that thus far the sugar palm has not been given proper consideration as one of the most easily managed and most cheaply cared for of all the tropical crops. Furthermore, under modern methods it is obviously a highly profitable plant.

SUGAR-PALM SAP.

By C. W. HINES, *Station Superintendent.*

Experiments with the sap of the sugar palm (*Arenga saccharifera*) were carried on in the region of Silang, Cavite Province, at an altitude of some 450 meters above sea level.

There seems to be some difference in the sap flow of trees grown in the low, wet soil, where an abundance of moisture is always available, although this difference is not so marked as with shallower-rooted saccharifeous plants. It is claimed, too, that the flow is usually greater during the rainy season than during the dry season, and greater during the night than during the day.

Careful observations were made on a number of trees, and in the following tables the typical cases are recorded:

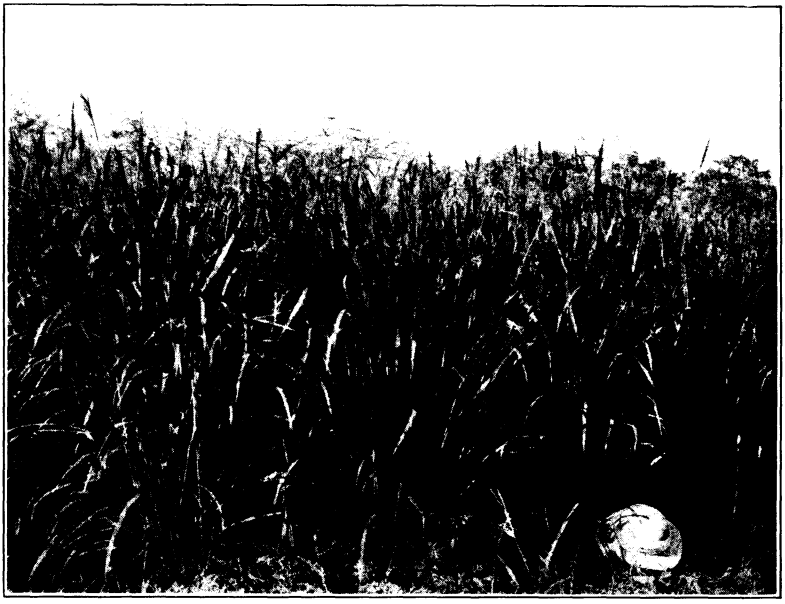
Tree No. 1.—This tree was located in a medium dense jungle and was fairly vigorous in growth. It carried six very large bunches of green fruits. Observations were begun the fifth day after tapping.

Date.	Quantity of sap.	Date.	Quantity of sap.
	c. c.		*c. c.*
Feb. 21:		Feb. 24:	
Morning	5,300	Morning	5,950
Evening	5,100	Evening	5,800
Feb. 22:		Feb. 25:	
Morning	5,600	Morning	5,940
Evening	6,300	Evening	5,825
Feb. 23:		Feb. 26:	
Morning	6,000	Morning	5,935
Evening	5,780		

Tree No. 2.—This tree was located in a jungle with many other similar trees near by. It was fairly vigorous in growth and carried three large bunches of green fruits. The data here given were taken seven weeks after the peduncle was tapped.

Date.	Quantity of sap.	Date.	Quantity of sap.
	c. c.		*c. c.*
Feb. 20:		Feb. 23:	
Morning	1,200	Morning	1,100
Evening	1,100	Evening	1,085
Feb. 21:		Feb. 24:	
Morning	1,190	Morning	1,150
Evening	1,110	Evening	1,045
Feb. 22:		Feb. 25:	
Morning	1,205	Morning	1,100
Evening	1,090	Evening	1,010

Guinea grass at the Lamao experiment station, 1913.



Guinea grass bearing seed.

Kaong, or sugar palm; two male inflorescences ready for tapping, with cord for swinging.

Sugar palm; panahod, or receptacle, in position, and three buds showing. Silang, Cavite.

Kaong; starch making; local method. Silang, Cavite.

Tree No. 3.—This tree was located near the main road in an open part of the forest. It had been tapped two months, and the sap was being used for the manufacture of vinegar.

Date.	Quantity of sap.	Date.	Quantity of sap.
Feb. 20:	*c. c.*	Feb. 22:	*c. c.*
Morning	1,300	Morning	1,200
Evening	1,000	Evening	1,125
Feb. 21:			
Morning	1,250		
Evening	1,100		

The above sap measurements were taken at 6 a. m. and 6 p. m.

	Tree No.—		
	1.	2.	3.
	Per cent.	*Per cent.*	*Per cent.*
Total solids	17.1	17.21	16.89
Sucrose	15.41	15.6	14.9
Reducing sugars	.01	Trace.	.02
Acidity to N/10, NaOH	Trace.	Trace.	Trace.

Observations and sap measurements were made on a large number of other trees but these results give a good general average for all. It was observed that strictly fresh sap reduced but slightly the copper in Fehling solution. The average of all samples would indicate a percentage of but 0.02 reducing sugar, when the sap had been caught in sterilized containers and the cut end of the peduncle and its "lip" with which the sap came in contact properly sterilized.

One very peculiar fact with this sap, in comparison with saps of other saccharifierous plants, is its extremely low acidity; samples when strictly fresh showed only a trace of acid. It was noticed, however, that the *untreated* sap very promptly fermented when exposed to the air, and the acidity soon began to rise. The following experiments with preservatives and methods of clarification were conducted to determine proper methods of handling the sap in the manufacture of sugar.

Experiment No. 1.—Four thousand cubic centimeters of sap were treated with formalin, which acted very satisfactorily as a preservative. This sap was then acidified with phosphoric acid to 0.7 cubic centimeters against tenth normal sodium hydroxide, using phenolphthalein as an indicator. Calcium hydroxide was then added in the form of milk of lime of 15 Baumé, until the acidity was reduced to 0.2 cubic centimeters. A copious precipitate settled to the bottom in a short time with a clear

supernatant liquid, which was filtered off and boiled in a copper receptacle, under atmospheric pressure, to a massecuite of 86° Brix. It was observed that while heating this liquid for some time to nearly 100° C. the impurities remaining were changed to a darker color, which continued to grow still darker on prolonged boiling. As a result of this last effect, the final massecuite had a dark color.

Another portion of this sap acidified with sulphur dioxide instead of phosphoric acid and treated in the same manner as above gave similar results.

Chloroform was also used as a preservative in duplicates of the above experiments, and proved equally as satisfactory.

Experiment No. 2.—This sap was preserved by having the porcelain receivers washed with milk of lime and enough of the above reagent placed in the vessel to give an alkalinity of 5 cubic centimeters against tenth normal acid when 4,000 cubic centimeters of the juice had been collected.

While the sap thus preserved would remain unfermented long enough to permit of its manufacture into sugar on a large scale, yet this method was found to be not as efficient as the formalin. One sample of this sap was clarified by carbonating to 0.1 cubic centimeter alkalinity and precipitated fairly well.

The clear liquid was drawn off and boiled to a massecuite of 86° Brix. It was observed that heating near the boiling point for a very short time caused this alkaline sap to turn dark, giving a poor grade of massecuite.

Another portion of this sap was carbonated until the alkalinity of 0.1 cubic centimeter was reached. Phosphoric acid was then added until the acidity of 0.4 was attained. It was then allowed to precipitate and settle well, after which the clear liquid was drawn off and boiled to a massecuite of 86° Brix. A very good grade of thick sirup was made of a satisfactory color.

Another portion of the same sap, carried through in identically the same manner as the above except that the acidity was produced with sulphur dioxid, gave a somewhat clearer thin liquor, because of the better bleaching of the nonsugars, but the final results were practically the same.

Experiment No. 3.—Alcohol was used as a preservative in this case, 100 cubic centimeters being added to each 4,000 cubic centimeters of sample. This proved very satisfactory as a preservative, besides acting chemically on some of the nonsugars and throwing them down as a precipitant. Phosphoric acid was added until an acidity of 0.8 cubic centimeters was reached, after which milk of lime was added until the acidity was reduced

to 0.1 cubic centimeter. The impurities settled fairly quickly and the supernatant liquor was very clear. This was boiled to a massecuite of 86° Brix, which turned only slightly darker after the density of about 50° Brix was reached.

Another portion was treated in the same manner as the above, except that sulphur dioxid was used instead of phosphoric acid. While this clarified juice had a slightly brighter color than the above, the resulting massecuite was unimproved.

A third portion was limed to 0.2 alkalinity and carbonated to neutrality. This caused a dense flocculent precipitate to fall and left a clear supernatant liquor, which gave a very satisfactory massecuite.

Experiment No. 4.—A trial was then made by heating the sap to the boiling point; this, together with the alcohol, had the effect of precipitating albuminous matter, pectin bodies, etc., which very readily filtered off. The filtrate was then treated with milk of lime of 15 Baumé until an alkalinity of 0.3 was reached. This was then carbonated to 0.3 acidity which caused another heavy precipitate to fall immediately leaving a perfectly clear supernatant liquor. A beautiful, light, clear massecuite of 86° Brix was made from this sap which began to crystallize after three days, and at the end of five days was filled with sharp, clear crystals and a very light-colored molasses. This sugar was easily drained of the thin molasses and washed to a high-grade sugar with very little clear water.

Subsequent experiments with this method confirmed the above results and gave a rise in purity of from 3 to 6 points.

The same method was then used in the making of sirup and gave a light-colored heavy liquor of 56° Brix with an excellent flavor.

The secret of this method of clarification lies in the preheating of the sap to the boiling point, or in treatment with alcohol, either having the effect of sterilizing the sap as well as precipitating albumens, albuminoids, pectin bodies, etc. While the alcoholic treatment may be dispensed with, yet this will give excellent results whenever practical to employ it.

Where a sufficient number of trees are available there is no reason why first-class sugar and a very superior sirup can not be made with a minimum expense in installing the plant.

Since this sap ferments so readily it would be absolutely necessary to keep everything scrupulously clean, especially the receptacles which contain the sap and thin liquors. This may be done with formalin, boiling water, milk of lime, etc. The receivers used at the trees may be cleaned with milk of lime and

some formalin placed in the bottom to preserve the sap as it falls into the vessel.

For the actual clarification work a very small amount of lime and carbon dioxid will be required. This carbon-dioxid gas may be recovered from the kiln where lime is burned, or from the smokestack gas, if a good combustion is attained. The writer superintended a sugar factory, using the carbonation process where the gas from the lime kiln averaged 25 per cent carbon dioxid for the campaign, while that from the smokestack averaged 12 per cent. This simply means that two volumes of the latter will perform the same action as one of the former. Indeed, experiments performed in this factory proved the feasibility of using these flue gasses with equally good results. It is well to provide a washing apparatus through which this gas must first pass before entering the liquor.

Where a grove of sufficient magnitude is available it would certainly pay well to install a plant in which evaporation under reduced pressure might be practiced, especially when a high grade of refined sugar is desired. With only a few trees, however, a galvanized or copper open-train apparatus, like those employed in the maple-sugar industry, may very well be used, especially in making high-grade sirup and molasses sugars for direct consumption. Indeed such an industry would soon gain wide popularity and net good profits, since the impurities contained, like those in the maple products, lend very pleasing flavors and thus are responsible for the high commercial value.

The sap from these trees will flow for at least two months and sometimes three. On an average, trees in full flow will give from 10 to 12 liters (2½ to 3 gallons) per day, while at the end of one and one-half months it is usually diminished to 6 or 8 liters, and at the end of two and one-half months to 2 liters; taking on an average, then, 6 liters per day for sixty days, we have 360 liters of sap with a specific gravity of 1.07, or about 385 kilos of sap containing 14 per cent sucrose, or 54 kilos of sucrose in the form of a molasses sugar of about 90 purity, which is equal to about 60 kilos of sugar.

It should be possible to plant at least 150 to 175 trees per hectare. Considering, then, an average of 160, we thus have 9,600 kilos of sugar, on a basis of one tapping per tree. In point of fact, each mature "female" palm will normally produce two or three male inflorescences per year, and if the female flower buds are removed as soon as recognized, this number would probably be doubled. Twenty tons per hectare would, therefore, appear to be the minimum yield per annum. The

sugar is worth about 15 centavos per kilo. Each hectare will yield, therefore, about ₱1,500 per year for every one-bunch-per-tree unit; thus, if each tree yields but two male inflorescences in the twelve months, the sugar crop will still be worth ₱3,000 per hectare ($600 gold per acre). In this estimate we are considering that *all* trees will bear male flowers.

MANUFACTURE OF ALCOHOL.

As stated before, the juice from this tree is very readily inverted by an enzyme, giving dextrose and levulose, or "invert" sugar. These in turn are changed by a fermentation germ into alcohol and then into acetic acid and impurities, or vinegar. The following chemical action takes place:

$C_{12}H_{22}O_{11}$ or sucrose (m. w. 342) + H_2O (water)

in the presence of an enzyme gives

$C_6H_{12}O_6$ or dextrose (m. w. 180) + $C_6H_{12}O_6$ or levulose (m. w. 180);

this in the presence of fermentation germs breaks up into

$4(C_2H_6O)$ or Alcohol (m. w. 184) + $4(CO_2)$ (carbon dioxid);
$4(CH_3CH_2OH) + 4(O)$ (free oxygen) =
$4(CH_3COOH)$ or acetic acid (m. w. 60) + $4(H_2O)$.

We see, therefore, that 342 parts of sucrose will yield 184 parts of alcohol, or approximately 50 per cent of itself by weight, and 342 parts sucrose will yield 240 parts, or 70 per cent of its weight in acetic acid.

Each liter of sap containing 14 per cent sucrose should then give us 70 grams absolute alcohol provided there is perfect oxidation and no loss, or about 80 cubic centimeters of 90 per cent alcohol; i. e., over 28 liters for each tapping.

VINEGAR.

The average vinegar of commerce contains from 2 to 6 per cent acetic acid.

One liter of this sap with proper oxidation will give us 1.8 liters of a 4 per cent vinegar.

On account of the ease with which this vinegar is made, as well as the high yield of a good-grade article, a large part of the kaong sap in Cavite Province is converted into vinegar.

STARCH.

The "male" tree which bears only the abortive female flowers may be made to yield heavily in starch, if properly treated. Indeed, this is an industry as profitable, perhaps, as that of the sugar and sirup. The flowers which form on this class of trees

are never fertile, and consequently never produce a mature fruit, but usually drop off in the form of a hollow shell. The stems of these inflorescences are usually cut as fast as they appear for a year or more before the tree is felled for starch.

Testing for starch.—In testing these trees to determine whether they are ready to be cut it is customary to chop a deep notch near the base of the trunk and test a fragment of the interior to determine its degree "ripeness" for starch.

Starch making.—The tree is cut down near the ground and the main part of the trunk cut up into blocks or chips. These are removed to the place where the starch is to be extracted and chopped into fine bits with bolos (cutlasses) or large knives. This finely chopped material is put into a wooden or stone mortar and pounded until it is reduced to a coarse meal. It is then placed in a wooden or stone vat and washed thoroughly to separate the starch grains. The water, containing the starch and suspended impurities, is run into a settling tub; the coarser particles are taken back to the mortar and again pounded. This operation is repeated until all of the starch has been removed.

Washing the starch.—In order to purify the starch it is washed through a number of changes of water by stirring thoroughly and letting it settle each time. The starch being heavier than the impurities will settle to the bottom, leaving the latter in a thin layer above. This liquid with the impurities is poured off and fresh water added, and the operation repeated until the final starch is turned out, white and comparatively pure. It is then dried in the sun, reduced to a fine powder, and is ready for market.

A form of sago is sometimes made from this starch, which is highly prized by the Filipinos.

Yield of starch.—The yield varies greatly with the individual trees. Here in the Philippines the Filipinos usually consider from 50 to 75 kilos a fair recovery.

By-products.—After the starch has been removed the remaining fiber and finely chopped particles are boiled to a gruel and used as feed for pigs.

Labor required.—The labor required to manufacture a tree into starch under the antiquated methods practised here is comparatively great. Two men working two and one-half days accomplish this task. A machine could be made containing chopping knives which would very readily reduce the material to fine particles whereby the starch would be more efficiently extracted, and thus greatly reduce the cost of manufacture.

MEMORANDUM UPON ESTIMATED EXPENSES FOR ESTABLISHING A COPRA CENTRAL ON A PLANTATION OF 5,000 HECTARES (12,000 ACRES).

By O. W. BARRETT, *Chief, Division of Horticulture.*

INTRODUCTION.

In view of the fact that there is a strong and growing interest in coconut culture in the Philippine Islands, and at the same time a tendency to form combinations of plantations, or "copra centrals," it would seem expedient to furnish detailed estimates of the cost of establishing such centrals or large estates here.

Unfortunately, it is practically impossible for the prospective coconut planter to lease or purchase bearing plantations anywhere in the Philippine Islands at present; on the other hand, there are unquestionable advantages and facilities in the way of his acquiring large areas suitable for the establishment of modern coconut groves. In Bulletin No. 25, "The Coconut Industry of the Philippine Islands," details relative to the acquisition of Government lands are set forth. In this bulletin, however, the estimates given for "bringing in" only moderate-sized plantations are quoted.

In this connection it should be borne in mind that while a small plantation may cost disproportionately high in the preparatory stage, larger estates cost relatively much less per hectare, both in the operating expenses and, if well managed, in the overhead charges. The returns from a copra central of, say, one-fourth or one-tenth the size of that under consideration in the following memorandum, should be only a little less, proportionately, than those from the large centrals. Just as with sugar cane, for instance, a certain amount of momentum, as it were, must be acquired by means of capital before the potential profitableness inherent in the system will be in evidence.

The following estimates are based upon data gathered from reliable sources and are believed to be well within the limits of practicability. The figures here given are for a plantation

in moderately good soil situated anywhere in the Philippine Islands outside of the typhoon belt.

It is understood that 1,000 hectares (2,400 acres) of land are to be cleared the first year, 200 hectares (480 acres) of this being set with abacá and 500 hectares (1,200 acres) with coconuts, 300 hectares (720 acres) being left for the central plant, roadways, barrios for laborers, pastures, gardens, etc. The second year 2,000 hectares (4,800 acres) are to be cleared, and one-half planted with abacá (manila hemp) and one-half with coconuts. During the third and also during the fourth years, 1,000 hectares (2,400 acres) are to be cleared and planted with coconuts. The trees are to be set (in "block" system, i. e., rows alternating 8 by 10 meters, or 20 by 32½ feet) 125 to the hectare (50 per acre).

Items of plant.

Main office building (furnished)	₱5,000	
Bungalow for—		
Director	3,000	
Agronomist	2,500	
Field superintendent	2,500	
Bungalows for 3 assistants, at ₱1,000	3,000	
300 cottages for laborers, at ₱75	22,500	
Warehouse	3,000	
2 churches, at ₱1,000	2,000	
4 schoolhouses, at ₱750	3,000	
3 tool houses	1,500	
Machine shop and storehouse	3,000	
Commissary building	4,000	
Hospital with furnishings	3,000	
50 kilometers woven-wire fence	20,000	
Tools and equipment including 3 traction engines, 6 donkey engines with drums, 12 complete stump pullers, 50 field harrows, 50 ordinary plows, 1 motor launch, and minor implements (axes, bolos, shovels, etc.)	75,000	
Work animals, including 50 carabaos, 100 cattle, 10 horses	25,000	
Live stock, including 200 brood sows and 10 boars	3,000	
Commissary goods and store stock	5,000	
Ice plant	3,000	
Water supply	5,000	
Dock and freight bodega	5,000	
		₱199,000

Operating expenses, first year.

Salaries of director, agronomist, superintendent, and assistants, including medical inspector, accountant, cashier, machinist, storekeeper, and assistants	50,000	
Labor, 300 men, at ₱0.75 per day (with partial subsistence), averaging 20 days per month	60,000	
65,000 selected seed nuts	3,250	
220,000 abacá suckers, at ₱60 per 1,000 (delivered)	13,200	
Miscellaneous supplies	10,000	
General maintenance of plant	10,000	
Road construction	5,000	
Fence building	5,000	
Depreciation of stock and renewal of small items	10,000	
Interest on ₱1,000,000, at 4 per cent	40,000	
		206,450
Total for plant and first year's expenses		405,450

Operating expenses, second year.

Salaries	₱60,000	
Labor	100,000	
130,000 seed nuts	6,500	
1,100,000 abacá suckers	66,000	
Miscellaneous supplies	25,000	
General maintenance of plant	15,000	
Fence construction	5,000	
Depreciation of stock and renewal of small items	15,000	
Interest on ₱1,000,000	40,000	
		₱332,500
Total expenses to end of second year		737,950

Operating expenses, third year.

Salaries	₱70,000	
Labor	75,000	
130,000 seed coconuts	6,500	
Miscellaneous supplies	20,000	
General maintenance	20,000	
Fence construction	5,000	
Additional buildings including laborers' cottages, etc	10,000	
Depreciation of stock and renewal of small items	15,000	
Interest on ₱1,000,000	40,000	
	261,500	

Income.

110 tons of abacá, at ₱400	44,000	
Pigs	15,000	
	59,000	
		202,500
Total expenditures to end of third year		940,450

Operating expenses, fourth year.

Salaries	75,000	
Labor	75,000	
130,000 seed coconuts	6,500	
4 artificial dryers for copra, at ₱10,000	40,000	
Miscellaneous supplies	15,000	
General maintenance	15,000	
Fence construction	3,000	
Depreciation	15,000	
Interest on ₱1,000,000	40,000	
	284,500	

Income.

220 tons abacá (from 200 hectares)	88,000	
550 tons abacá (from 1,000 hectares)	220,000	
Pigs	20,000	
	328,000	
	284,500	
Net gain during fourth year		43,500
Total expenditures to end of fourth year		896,950

Operating expenses, fifth year.

Salaries	75,000	
Labor	75,000	
Miscellaneous supplies	15,000	
General maintenance	15,000	
Depreciation	15,000	
Interest	40,000	
	235,000	

Income.

1,320 tons abacá (full crop)	₱528,000		
Pigs	25,000		
625,000 coconuts from Grove A (first 500 hectares, 62,500 trees, 10 nuts per tree)	25,000		
		₱578,000	
		235,000	
Credit balance for fifth year			₱343,000
Total net expenditures to end of fifth year			553,950

Operating expenses, sixth year.

Salaries	80,000		
Labor	75,000		
Supplies	20,000		
Maintenance	20,000		
Depreciation	20,000		
Additional buildings and laborers' cottages	20,000		
Interest	40,000		
	275,000		

Income.

1,320 tons of abacá	528,000		
Pigs	25,000		
2,500,000 coconuts from Grove A (first 500 hectares, 62,500 trees, 40 nuts per tree)	100,000		
1,250,000 coconuts from Grove B (first 1,000 hectares, 125,000 trees, 10 nuts per tree)	50,000		
		703,000	
		275,000	
Credit balance for sixth year			428,000
Total debit balance at end of sixth year			125,950

Operating expenses, seventh year.

Salaries	80,000		
Labor	75,000		
Supplies	20,000		
Maintenance	20,000		
Depreciation	20,000		
Narrow-gauge car tracks and rolling stock	25,000		
Interest on ₱1,000,000	40,000		
	280,000		

Income.

1,320 tons of abacá	528,000		
Pigs	25,000		
3,750,000 nuts from Grove A (62,500 trees, 60 nuts per tree)	150,000		
5,000,000 nuts from Grove B (125,000 trees, 40 nuts per tree)	200,000		
1,250,000 nuts from Grove C (125,000 trees, 10 nuts per tree)	50,000		
		953,000	
		280,000	
Net return, seventh year			673,000
			125,950
Credit balance at end of seventh year			547,050
20 per cent dividend			200,000
Sinking fund			347,050

Operating expenses, eighth year.

Salaries	₱85,000	
Labor	80,000	
Extension of drying plants	40,000	
Supplies	25,000	
Maintenance	25,000	
Depreciation	20,000	
Interest	40,000	
	315,000	

Income.

1,320 tons of abacá	528,000		
5,000,000 coconuts from Grove A (62,500 trees, 80 nuts per tree)	200,000		
7,500,000 coconuts from Grove B (125,000 trees, 60 nuts per tree)	300,000		
5,000,000 coconuts from Grove C (125,000 trees, 40 nuts per tree)	200,000		
1,250,000 coconuts from Grove D (125,000 trees, 10 nuts per tree)	50,000		
Interest on sinking fund	13,882		
		₱1,291,882	
		315,000	
			₱976,882
Credit balance for eighth year			1,323,932
Repayment of principal			1,000,000
			323,932
20 per cent dividend			200,000
Sinking fund			123,932

Operating expenses, ninth year.

Salaries	85,000	
Labor	80,000	
Supplies	25,000	
Maintenance	25,000	
Depreciation	20,000	
	235,000	

Income.

1,320 tons of abacá	528,000		
6,250,000 nuts from Grove A (100 nuts per tree)	250,000		
10,000,000 nuts from Grove B (80 nuts per tree)	400,000		
7,500,000 nuts from Grove C (60 nuts per tree)	300,000		
5,000,000 nuts from Grove D (40 nuts per tree)	200,000		
Interest on ₱123,932	4,957		
		1,682,957	
		235,000	
			1,447,957
Credit balance at end of ninth year			1,571,889
60 per cent dividend			600,000
Sinking fund			971,889

Operating expenses, tenth year.

Salaries	90,000
Labor	80,000
Supplies	25,000
Maintenance	30,000
Depreciation	20,000
4 new drying plants	200,000
2 copra steamers	300,000
	745,000

Income.

990 tons abacá (⅔ full crop)	₱396,000		
6,250,000 nuts from Grove A (100 nuts per tree)	250,000		
12,500,000 nuts from Grove B (100 nuts per tree)	500,000		
10,000,000 nuts from Grove C (80 nuts per tree)	400,000		
7,500,000 nuts from Grove D (60 nuts per tree)	300,000		
Interest on ₱971,889	38,875		
		₱1,884,875	
		745,000	
			₱1,139,875
			2,111,764
150 per cent dividend			1,500,000
Sinking fund			611,764

Operating expenses, eleventh year.

Salaries	100,000		
Labor	90,000		
Supplies	35,000		
Maintenance	30,000		
Depreciation	40,000		
	295,000		

Income.

990 tons abacá (¾ crop)	396,000		
31,250,000 nuts from 312,500 trees	1,250,000		
10,000,000 nuts from Grove D (80 nuts per tree)	400,000		
Interest on ₱611,764	24,470		
		2,070,470	
		295,000	
			1,775,470
			2,387,234
200 per cent dividend			2,000,000
Sinking fund			387,234

Operating expenses, twelfth year.

Salaries	120,000		
Labor	90,000		
Supplies	50,000		
Maintenance	40,000		
Depreciation	50,000		
	350,000		

Income.

43,750,000 nuts (from the 437,500 trees)	1,750,000		
990 tons abacá (¾ crop)	396,000		
Interest on ₱387,234	15,489		
		2,161,489	
		350,000	
			1,811,489
			2,198,723
200 per cent dividend			2,000,000
Sinking fund			198,723

The preceding figures are based upon the assumption that the land to be brought under cultivation is moderately forested and so located that transportation facilities are fairly favorable. Expenses for clearing will of necessity vary considerably according to the nature of the land; for instance, the expense of

clearing 2,000 hectares in the second year may cost more than the ₱100,000 estimated, or in fact on heavily forested ground it *might* be necessary to double this amount. On the other hand, it is expected, as a matter of course, that the most suitable land of the entire area would be selected for the scene of operations in the busy second year and all economy in the way of plowing and treatment of interspaces would be given the best attention; in other words, to save expenditures which could be carried over in part, at least, into the third and fourth years' expenses, the coconuts transplanted in the 1,000 hectares to be planted in this crop, will be given only a reasonable amount of care, merely a fair amount of space around each young tree being kept in good condition of tilth. During the third and fourth years the interspaces in the first fields are gradually reduced to the state which permits the cultivation of maize as a catch crop.

By same token, it is not necessary and is not considered good economy to bring into the "fallow" condition more than a moderate proportion of the area cleared, during the first and second years. Both abacá and coconuts succeed splendidly on ground that is newly "brought in," provided a small area immediately about the young plants is kept friable and free from weeds and grass; thus the plowing expense item can be kept down to a very low figure.

Maize planting should proceed gradually, as a coconut catch crop; it would quite likely be advisable to plan one or two crops of maize in the abacá plantation; any surplus grain not needed for the pig stock will find a ready local market.

Should large areas of more or less level ground free from heavy stumps be encountered, it *might* be well to purchase one or two sets of the cable-system steam plows; this would mean an extra expenditure during the first or second years, presumably, of about ₱40,000 for each set.

The office building can be furnished at once with modern office fixtures including an (expensive) safe, and imported equipment, or these expenditures can be arranged for gradually as the business increases.

If it should be found necessary to use a small locomotive on narrow-gauge tracks for hauling nuts to and copra from the dryers and for other similar transportation services an extra ₱50,000 to ₱100,000 might be required.

Theoretically, an oil plant should be established in conjunction with a plantation of this magnitude; the estate would then

become a *coconut-oil* instead of a copra central. The expense in drying the "meat" would be obviated by turning the nuts directly into oil. The operation of the oil plant would call for a very heavy expenditure (perhaps a million pesos or more) for oil containers for long distance shipment; by the same token, this plant might or might not, according to local conditions, avoid the necessity of purchasing the freight steamers to handle the more bulky copra.

If the topography is very uneven more expense may be entailed in the fencing and road-making operations, the construction of buildings, etc. It might be well to add, even in the first year, several subsidiary commissary depots; once constructed however, these should be self-supporting, the receipts always going back into supplies, and the low profits amply covering all operating expenses and permitting a moderate increase of stock.

Under some circumstances the maize-pig system may be impracticable. For quick and good returns, however, abacá will be found, in nearly every case, to be an indispensable secondary crop.

Briefly speaking, the labor expenditures, at least for the first two years, may be increased, if conditions are *not* moderately good, by 50 to 100 per cent. Expenditures for machinery, buildings, etc., may also be increased during the first three years, through more or less adverse conditions, by 25 to 50 per cent.

On the other hand, however, it is believed the income from both coconuts and abacá is put well below the normal outturn of an estate of this size managed according to the approved methods of modern agronomy. The present price of coconuts is (according to locality) 10 to 20 per cent higher than the rate allowed in these figures.

The abacá receipts will fall to about one half full crop in the 13th, 14th, and 15th years. At about the 15th year the 1,200 hectares of abacá should be grubbed up and planted in coconuts.

Speaking of the *average conditions* in India, Simmonds[1] states:

> Spathes or shoots, from which eventually the flowers are to appear, will begin to make their appearance in the sixth year, but some kinds of coco palm, as the Nicobar, even before this * * * The produce of the tree in full health and properly tended is much dependent on soil and climate. The average may be put down at 120 nuts in the twelve months, while in a low and sandy soil it will amount to 200.

[1] Simmonds, Tropical Agriculture.

Although many trees in the well-kept grove will yield 200 nuts, and some even 300 (the record being, it is believed, about 470), it would not be safe to count upon more than 125 to 150 per tree *on the average* "year in and year out."

The trees are in their prime at the twentieth to the fortieth years and keep up without much change to about the sixtieth or eightieth year, i. e., the annual dividend will be from 150 to 250 per cent till about the one hundredth year.

It is therefore obvious that coconuts are not only the safest but probably the most profitable tropical crop in the world.

These estimates are prepared by the Bureau of Agriculture, Department of Public Instruction, Government of the Philippine Islands.

CURRENT NOTES—MAY.

NOTES BY O. W. BARRETT, Chief, Division of Horticulture.

NEW COCONUT-OIL TROUBLES.

The most serious setback this commodity has had of late appears to be the new method of solidifying thin vegetable oils. For several years manufacturing chemists have been endeavoring to find a way to make tallowlike substances from liquid oils such as cotton-seed, peanut, etc.; and according to the Daily Consular and Trade Reports of the United States Department of Commerce, an oil-hardening plant has been opened at Fredrikstad in Norway. This plant was established with the object of hardening whale oils for the soap industry, but it seems now to be possible to solidify, at the rate of 1,000 barrels per day, either cotton-seed or peanut oil for the margarin makers.

This is really a serious thing as affecting the coconut-oil trade, for although there is and probably for many years will be a very strong demand for this perfectly wholesome vegetable food oil, any factor which permits a cheaper rival product to compete with it must needs make the Philippine coconut planter look to his laurels.

According to the American consul at Colombo it is possible that certain mineral oils are being used to a small extent as adulterants of coconut oil.

VANILLA DIFFICULTIES.

Perhaps the most highly remunerative of all tropical crops, under favorable conditions, is vanilla. It is only now and then, however, that this plant can be grown without severe losses from insect pests, fungus diseases, bad weather, and pollination troubles.

Outside of Mexico, Colombia, and Central America, Madagascar continues to hold first rank for cultivated vanilla. In 1912 this country exported no less than ₱1,520,000 worth of the product. Plantations in the neighboring colonies of Grand Comore and Mayotte are also turning out a large amount of first-class "pods."

A recent letter from the Society Islands states that several insect pests are beginning to give a great deal of trouble there even when carefully watched. On account of the extreme delicacy of the tissues of all varieties of vanilla, it is impracticable to use any form of spray for either fungus or insect troubles since in such case the remedy would be more harmful than the disease.

If the price of "pods" keeps up to ₱5 per kilo (on the plantation), the outcome of the Bureau's experiments with vanilla at the Lamao experiment station will undoubtedly be highly successful.

YLANG-YLANG OIL.

Although the business in this product practically came to a sad end in the Philippine Islands several years ago, it appears to be still flourishing in Reunion, Madagascar, and the Comoro Islands. In 1912 Reunion exported some ₱160,000 worth of "Ihlang-ihlang" and while this sum is by no means small, as an article of export it is not to be compared with the ₱650,000 worth of geranium oil exported by that country in the same year.

This Bureau has just received an order for a large quantity of ylang-ylang seeds to be sent to Indo-China.

NOTES BY P. J. WESTER, Horticulturist in charge of Lamao Experiment Station.

ROSELLE RECIPES.

The one distinctly new and recent plant immigrant that has perhaps been more widely distributed to all parts of the Archipelago, and received more attention by the people at large, is unquestionably the roselle. The Bureau frequently receives reports about its luxuriant growth, generally accompanied by a statement that the writer does not know how to prepare the fruit.

Directions for the preparation of roselle sauce, jelly, sirup, and wine have previously been published in the REVIEW.[1] The following roselle recipes from a pamphlet recently issued by Mr. E. L. Worcester, Cabanatuan, Nueva Ecija, a grower and manufacturer of roselle products, may be of interest to the readers of the REVIEW.

Baked roselle pudding.—Take 1 cup flour, 2 teaspoons baking powder, ¼ teaspoon salt, 2 tablespoons crisco, sufficient milk to make soft dough.

[1] Vol. V, No. 3, 1912. Vol. VI, No. 5, 1913.

Pour 1½ cups roselle sauce in enamel-ware or porcelain dish, cover with dough, and bake 30 minutes in moderate oven.

Serve with hard sauce flavored with roselle sirup or roselle jelly.

Roselle cake.—Take 1 cup sugar, 1 rounding tablespoon crisco, 2 eggs, ½ cup milk, ¼ teaspoon salt, 1¾ cups flour, 2½ teaspoons baking powder. Mix in order given. Bake in buttered and floured round layer-cake pans 15 to 20 minutes in a moderate oven. Put frosting between layers and on top of the cake.

Frosting: Boil 1 cup sugar with ⅓ cup water until sirup will thread from tip of spoon. Pour sirup gradually on stiffly beaten white of one egg. Beat until of right consistency to spread. Spread evenly over cake and dot with bits of roselle jelly or, if preferred, mix 1 tablespoon roselle jelly with the frosting, or mix with the frosting and also dot with bits of the jelly.

Roselle cottage pudding.—Mix batter as for roselle cake. Place in a small dripping pan and bake 20 to 30 minutes in a moderate oven. Cut in squares and serve with roselle pudding sauce.

Roselle pudding sauce: One-half cup sugar, 1 tablespoon cornstarch, 1 tablespoon butter, ⅛ teaspoon salt. Mix well. Add 1 cup boiling water, stirring constantly. Boil 5 minutes. Remove from fire and add ½ cup roselle sirup. Serve hot.

Roselle gingerbread.—Take ⅓ cup crisco, ⅔ cup boiling water, 1 cup molasses, 1 egg, 2⅔ cups flour, ½ teaspoon soda, 1 teaspoon baking powder, ½ teaspoon salt, 1 teaspoon cinnamon, 1 teaspoon ginger, ¼ teaspoon cloves. Mix well and pour into a well-greased shallow pan and bake 30 minutes in a moderate oven. Cut in squares and serve hot with roselle pudding sauce.

Roselle jelly.—Use roselle sirup in combination with or in place of other flavors with or without fruit or nuts with gelatine.

Roselle jelly cake.—Use batter as for roselle cake. Bake in round layers and spread with roselle jelly. Sprinkle top of cake with granulated or powdered sugar. Serve warm or cold.

Roselle gulaman.—Cut in small pieces sufficient gulaman (gelatin) to fill 1 cup. Wash thoroughly and stir into 3 cups boiling water, boil until dissolved. Add ½ cup sugar and 1 cup roselle sirup. Remove from fire and add sufficient hot water to make 3½ cups (more or less water may be used depending upon how hard the product is desired), strain into mold and let stand 30 minutes to harden. When partly cool, cubes of fruit or nuts may be added if desired. Served with whipped and sweetened cream or with cream and sugar.

[NOTE.—This recipe may be used where ice is not available.]

Roselle pie.—Line a pie tin with puff or plain paste. Fill with roselle sauce, sprinkle with sugar, cover with lattice work or pastry. Bake 30 minutes in a moderate oven. Serve cold.

Roselle punch.—One pint roselle sirup, 1 quart finely cracked ice, ½ cup sugar, juice of 2 oranges.

Roselle roly-poly.—Make dough as for roselle shortcake. Roll ¼ inch thick, spread with roselle sauce, sprinkle with sugar. Roll up and place in a well-greased deep pan. Bake 30 minutes in a moderate oven and serve with hard or vanilla sauce.

Roselle sherbet.—One pint roselle sirup, 1 cup sugar, 1 quart water.

Mix and after putting in freezer add stiffly beaten white of one egg and freeze.

Roselle shortcake.—Take 2 cups flour, 4 teaspoons baking powder, ½ teaspoon salt, 2 teaspoons sugar, 4 tablespoons crisco, sufficient milk to mix. Place in a round pan and bake 20 minutes in a quick oven. When done split, spread with butter and then with roselle sauce. Serve warm or cold.

IMPROVEMENT OF THE PHILIPPINE CITRUS FRUITS.

One of the horticultural projects that have been accorded special attention by the Bureau of Agriculture during the last three years is the improvement of the Philippine citrus fruits. The writer has made several trips to the citrus district of Batangas in connection with the study of the bark-rot and has given instructions in grove sanitation, budding, and grafting. A year ago a special article was published in this Review in which the writer's observations relative to the conditions in the citrus district to that date were summarized, and a course of procedure for the improvement of the groves was outlined.

Beginning with January, 1914, the division of demonstration and extension detailed an agricultural inspector to assist and instruct the growers in the modernization of their methods of cultivation, and steps are now being taken to set out in Lipa an orchard containing all the superior introduced and native citrus fruits now in the collection at the Lamao experiment station.

Assisted by several members of the staff of the Bureau and particularly by Mr. E. F. Southwick, acting superintendent of the Cebu demonstration station, the writer has assembled at Lamao a collection of what probably includes the major part of the citrus types extant in the Philippines; here their adaptability as stockplants is being tested, and as the trees come into fruiting, their botanical relationships to each other and to the cultivated citrus fruits will be studied. Some of the native fruits are of good quality and may be expected to eventually take high rank among the world's cultivated citrus fruits, and these are being propagated for distribution in the Philippines.

Some 65 named varieties of citrus fruits, including oranges, mandarins, pomelos, lemons, limes, and citrons, have been imported from the citrus-growing regions abroad, and these are also being propagated at the Lamao experiment station for distribution to Philippine planters.

However, when the area of the Philippines, and the facilities for propagation by the Bureau of Agriculture are considered,

it must be obvious to all that if the improvement of the Philippine citrus fruits is to be dependent upon the free distribution of budded trees alone, this will of necessity proceed extremely slowly. Therefore, we would strongly urge that those who are interested either in raising the standard of excellence of these fruits of the Archipelago, or in the dissemination of those imported and superior sorts, should establish small nurseries of citrus seedling trees of such species as grow well in their respective localities. When the young plants in such nurseries have attained a height of about 75 centimeters the Director of Agriculture at Manila should be notified and if the number of seedlings propagated in a given locality is large enough to justify the expense, the Bureau will then send an experienced propagator with budwood of selected varieties to bud the plants, or, if desired, budwood will be mailed free of charge to applicants who are familiar with the art of budding and grafting.

If well cared for, budded trees may be expected to come into bearing three or four years from the insertion of the bud. The orange and the pomelo are considered to be good stocks; the lime may also be utilized as stock, though its root system is not so well developed. The orange, the pomelo, and the mandarin have been budded successfully on the cabuyao and the calamondin by the writer at this station, and so far the young plants are making a satisfactory growth; however, their ultimate value as stocks can be ascertained only when the trees come into bearing. In the meantime their use as stocks in a limited way is advised for all localities where these species succeed well, in order that their suitability as stocks may be determined.

Circular No. 24, Citrus Growing in the Philippines, will be mailed free to all applicants. All communications should be addressed to the Director of Agriculture, Manila.

NOTES BY D. B. PALMER, D. V. M.

A NEW METHOD OF PRODUCING ANESTHESIA.

One of the latest methods of producing anesthesia in domestic animals is that advanced by Professor Gill of the New York American Veterinary College, which consists of the injection of 10 cubic centimeters of filtered extract of *Cannabis americana* into the jugular vein. This is said to produce a profound slumber of such a deep degree that all the major operations can be performed without further restraint. The writer has tried this method several times and has not as yet obtained results that would justify the absolute acceptance of this method for general anesthesia.

TUBERCULOSIS IN HORSES.

Professor Lienaux, a Belgian veterinarian, reports in the Annales de Medecine Veterinaire, that he has observed four cases of tuberculosis in horses. This is a very rare occurrence, some authorities stating that tuberculosis never occurs in the equine species.

DIAGNOSES BY ROENTGEN PICTURES.

Dr. L. Edey, in Malmö, states that for diagnostic purposes, perfect Roentgen pictures of the foetus can be obtained in the beginning of the third month of pregnancy, also malformation and abnormal positions can be diagnosed in this manner. Further, the diagnosis of multiple foeti can be established without difficulty in the first half of the period of pregnancy. Hitherto injury to the feotus through Roentgen examinations has not been observed.

AMERICAN VETERINARIANS AT THE TENTH INTERNATIONAL VETERINARY CONGRESS.

The following American veterinarians have been invited to take part in the program of the Tenth International Veterinary Congress which is to be held in London, August 3 to 8, 1914: Doctor Mohler, United States Department of Agriculture, foot-and-mouth disease; Dr. A. D. Melvin, chief, United States Bureau of Animal Industry, public control of the distribution and sale of milk in the interests of public health; Dr. K. F. Meyer, ultra-visible viruses; Dr. W. H. Dalrymple, anthrax; Dr. Marion Dorset, hog cholera; Dr. L. A. Merillat, anthesia; Dr. W. L. Williams, surgical treatment of roaring; Dr. D. E. Salmon, classification, treatment, and prevention of diseases transmitted by ticks.

Most of these gentlemen have signified their intention of being present at the meeting.

BOOK REVIEWS.

By O. W. BARRETT, *Chief, Division of Horticulture.*

THE BANANA, ITS CULTIVATION, DISTRIBUTION AND COMMERCIAL USES.

By W. FAWCETT, B. Sc.

The tropical planter has long been in need of a work like this. The author, who was for some years the director of public gardens and plantations in Jamaica, has written this book with the special needs of the commercial banana grower in mind, and has based his text largely upon first-hand experience gathered in that country which has long been famous as the pioneer banana-producing country of the world. It is published under the auspices of the West India Committee by Duckworth & Co., of London. Sir Daniel Morris, D. Sc., F. L. S., has written a foreword in which he calls attention to the almost unprecedented success of the banana industry in the past fifty years.

The author has wisely included a chapter on fungus diseases and insect pests of the crop as well as some very interesting chapters on bananas as food, and on the various by-products of the industry. There is also an interesting but necessarily incomplete chapter on descriptions of the *Musa* species. The appendix gives a fine lot of recipes for cooking bananas and plantains.

In short, the book comes very apropos considering the fact that the banana industry has now reached the stage when it has outgrown, so to speak, the mere producer and has begun to affect the manufacturer of food products. It is of great service therefore not only to the planter who grows fresh fruit for the local market, but to the producer of the various dried and preserved foods and by-products of the world's most widely known fruit.

DATE GROWING IN THE OLD AND NEW WORLDS.

By PAUL B. POPENOE.

There have been several bulletins and rather incomplete pamphlets on date culture published during the past fifteen years, but it was left for the young but already famous explorer, plant collector, and author, to produce the first really complete publication on this very important fruit crop.

This atractively bound book, published by George Rice & Sons, at Los Angeles, California (price ₱4), contains 316 pages and 40 full-page illustrations from excellent photographs; there are 15 chapters in the text of part first and 93 pages, comprising part second, of descriptions of the principal varieties now grown in both the Eastern and Western Hemispheres.

Throughout this delightful volume the author has contrived to instill a certain atmosphere of active interest holding the reader to the point which he is discussing or explaining, and in most cases these glimpses behind the scenes are first-hand experiences of one who has traveled many thousands of miles to acquire accurate knowledge of this very old industry which is comparatively unknown outside of a very limited area in Northern Africa and Arabia. In view of the fact, however, that there are already some 75,000 date trees of known varieties in California and Arizona, a considerable proportion of which are already beginning to produce heavy crops worth from ₱0.50 to ₱4 per kilo, this compendium for both the producer and consumer is very timely.

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[1] On leave.